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Modern Surgery - Chapter 27. Diseases and Injuries of the Abdomen - Stomach and Intestines

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XXVII. DISEASES AND INJURIES OF THE ABDOMEN.

Diagnosis of Intra-abdominal Emergencies.—The exact diagnosis is always difficult and is not unusually impossible. What a surgeon must try to determine, and what he usually can determine, is whether he is dealing with a trivial and temporary derangement for the relief of which an operation is entirely unnecessary, or whether he is confronted with a grave calamity which imperatively demands immediate surgical aid. We can decide that a calamity exists, but the exact nature of the lesion is often doubtful until operation is performed. Every operation in such a case is exploratory. Before the diagnosis of a calamity is made morphin should not be given, because it allays the pain, relieves the anxiety, causes the disappearance of rigidity, lowers the pulse, abates shock, and hence veils the real situation, so that the most discerning surgeon will probably be misled. If shock is profound, diagnosis is usually impossible, unless shock is due to hemorrhage, and immediate operation during shock is not to be thought of except to arrest bleeding. If excessive and continued hemorrhage is suspected, immediate operation is indicated. If it is not suspected, the patient should be covered with blankets and surrounded with hot-water bags, atropin should be given hypodermatically, and hot salt solution should be administered by rectum, subcutaneously, or intravenously. Suprarenal extract is a valuable remedy to maintain blood-pressure in shock (Crile). When the patient reacts, and he usually will react, an attempt is made to make a diagnosis. It is perfectly proper to give a single hypodermatic injection of morphin (gr. $\frac{1}{3}$) after the effort has been made to diagnosticate the condition. The danger of deluding the surgeon is past and the drug abates pain, lessens peristalsis, relieves mental anxiety, and is distinctly beneficial. Before the morphin was given the surgeon came to a conclusion as to the necessity for operation. After the morphin has been given, if an operation is indicated, it is performed as promptly as circumstances admit. Whenever it is esteemed consistent with safety, the patient ought to be removed to a hospital for operation.

Contusion of the Abdominal Wall without Injury of Viscera.—

In some cases of contusion of the abdominal wall only the parietes are damaged; in other cases the viscera or the abdominal tissues are injured. Contusion may involve the skin alone, or may involve the skin, muscles, and peritoneum. In *simple contusion* there is considerable shock if the injury is severe. There is pain, increased by respiration, motion, pressure, and attempts at urination or defecation. When tenderness appears some days after the accident there is usually deep-seated injury. Extensive ecchymosis may appear. Even after a severe contusing force has been applied there may be no discoloration, and it may happen that after a slight force there is much discoloration. There is great ecchymosis in anemic persons, victims of hemiplegia, in obese individuals, opium-eaters, and drunkards. In severe cases the tissues are pulped and sloughing inevitably ensues. Abscess occasionally follows contusion. The prognosis after abdominal contusion is always uncertain.

Treatment of Simple Contusion.—In treating simple contusion place the patient at rest in a supine position, with the thighs flexed over a pillow; obtain reaction from the shock. Give morphin if pain is severe. After shock has passed off it is advisable to place an ice-bag over the seat of injury. If much blood is extravasated into the abdominal wall, aspirate and apply a binder. After twenty-four hours apply local heat by means of the hot-water bag, employ an ointment of ichthyol, and move the bowels, if necessary, by salines. Regard every contusion as serious, and watch carefully for the development of signs of internal hemorrhage or visceral injury.

Muscular Rupture from Contusion.—In this injury there are severe shock and pain (increased by respiration and movement). Separation between the fibers of the muscle is distinct at first, but it is soon masked by effusion of blood. Such injuries may cause death, or may lead to hernia. The rectus is the muscle most apt to rupture. The rupture is due to sudden contraction rather than to the direct effect of a blow.

The *treatment* is the same as for simple contusion. Always apply a binder. A hernia is returned and a compress is applied over the opening through which it emerged. If strangulation occurs, operate at once.

Injuries with Damage to the Peritoneum or the Viscera.—**Rupture of the Peritoneum.**—The peritoneum may be involved in an abdominal contusion. It may rupture even when there is no visceral injury or muscular contusion. The uterine peritoneum, the parietal peritoneum, the visceral peritoneum, or the mesentery may rupture. Rupture of the peritoneum causes intra-abdominal hemorrhage.

The *treatment* consists in opening the abdomen, arresting the hemorrhage, and bringing about reaction.

An injury to the peritoneum creates a point of least resistance, and at such a point peritonitis may develop. The peritonitis is usually local, but may become general. After any severe intra-abdominal injury the symptoms of *peritoneal shock* appear (*peritonism*), and the patient may rapidly die. In the condition of peritonism the temperature is subnormal; the extremities are cold; the face is pallid and sunken; the pulse is small, weak, and very frequent; the respiration is shallow and sighing; there is great thirst; the patient is restless and turns uneasily, and there is rigidity and distention. Vomiting almost always occurs. In some cases there is regurgitation rather than vomiting. The abdomen is the seat of a violent, persistent pain. The patient is fearful of impending death. As the symptoms develop in a grave case they will point to one of two conditions—hemorrhage or peritonitis.

In *intra-abdominal hemorrhage* the subnormal temperature and other evidences of shock persist. Vomiting ceases, but nausea exists. The patient is uncontrollably restless and tosses about in bed. The thirst is great. The abdomen is rarely rigid. Fainting-spells occur. Blood-examination shows a marked fall in the percentage of hemoglobin. Percussion demonstrates the existence of an effusion which alters its position as the patient's position is altered, and which gradually increases in amount. Dulness is first met with in the loins. Digital examination of the rectum or vagina may aid in diagnosis because in hemorrhage blood gathers in the rectovesical pouch. If peritonitis develops, the vomiting becomes worse, the pain intensifies, and the abdomen grows rigid and distended.

Rupture of the Stomach without External Wound.—The usual cause of rupture is a violent blow, although the accident may happen while washing out the stomach. Rupture is more apt to occur when the stomach is distended with food than when it is empty. The rupture may be partial, the peritoneal coat not being torn. The rupture may be complete. Either the anterior or the posterior wall may suffer. The region of the pylorus is most apt to be lacerated. The symptoms of rupture are collapse, severe pain over the entire abdomen, great thirst, excessive tenderness, especially over the epigastric region, occasionally vomiting, the vomited matter being usually, but not invariably, bloody; tympanitic distention and muscular rigidity coming on after a few hours. Austin Flint pointed out years ago that gas may enter the abdominal cavity and cause the diminution or disappearance of liver-dulness, but the area of liver-dulness can be lessened by great intestinal distention, and I have seen cases of perforation of the stomach and intestine in which it was not lessened at all. After *incomplete* rupture local peritonitis is frequent; in *complete* rupture the escape of food into the peritoneal cavity causes general peritonitis. The contents of the stomach are not so liable to escape after rupture of that viscus as are the contents of the intestine after rupture of the gut, because of the thickness of the stomach-wall and the tendency of the mucous membrane to evert and block the opening. Perforations of the anterior wall are most apt to lead to extravasation and general peritonitis. Posterior laceration may cause subphrenic abscess. To diagnosticate between complete and incomplete rupture, Senn endeavors to distend the viscus with hydrogen gas; in incomplete rupture the contour of the dilated stomach can be made out upon the surface; in complete rupture the viscus cannot be distended, and the gas passes into the peritoneal cavity, producing the physical signs of tympanites. This maneuver is open to the objection that it may increase extravasation in a complete rupture.

The *treatment* in complete rupture is as follows: if signs of hemorrhage are absent, endeavor to bring about reaction before operating. If these signs are present, operate at once, and have salt solution infused into a vein during the operation. Open the abdomen. If the seat of rupture is not visible, it may be found by inflating the stomach with hydrogen. Flush out the stomach and the peritoneal cavity with hot salt solution; sew up the stomach-wound with a double row of silk sutures, the first row being buried and including the muscular coat and mucous coat, the second row being Halsted sutures; drain; close the wound in the parietes with silkworm-gut; feed by the rectum for four days, and then begin the administration of a very little food by the mouth. In incomplete rupture the danger is perforation. The patient is put to bed, and after reaction has taken place, is fed by the rectum for several days, and morphin is given hypodermatically. Cases not operated upon occasionally recover, adhesions arising and perigastric suppuration taking place. The mortality is extremely large. In 1896 Petry collected 23 cases in which operation was not performed. The mortality was 59 per cent. This mortality is not so large as one would anticipate. It is not impossible that some of the cases were not positively instances of rupture. Nevertheless the lesion, for reasons previously stated, is not nearly so dangerous as rupture of the intestine. Another reason for

the greater danger of intestinal ruptures is that fecal matter is much more poisonous than the gastric contents. Laparotomy has lessened the mortality of rupture of the stomach. Petry and also Eisendrath mass together operations for rupture of the stomach and rupture of the intestine. Petry finds the group mortality to be 52.3 per cent., and Eisendrath finds it to be 52.5 per cent. Statistics referring to the stomach alone should show a lower death-rate.

Rupture of the Intestine without External Wound.—In a great majority of cases the damage is produced by direct violence. Homer Gage * collected 85 cases; in 75 the injury was due to direct force, and in 32 of these the force was inflicted by the kick of a horse or of a man. In one of my cases it was due to the kick of a horse, in one to the kick of a man, and in one to a crush inflicted by a cart-wheel. In 78 collected cases (Gage) the situation of the injury was specified: The duodenum, 10; jejunum, 20; ileum, 42; large intestine, 6. In many cases there is more than one tear, and sometimes many tears exist. The mesentery may be lacerated (in 7 per cent. of cases, according to Gage; in 16 per cent., according to Curtis). The symptoms of this injury are profound shock, tympanites, abdominal pain, and rigidity, rapidly followed by peritonitis if the patient survives. In some cases pain is referred to the back. Vomiting comes on soon after the accident, the vomited matters being possibly at first bloody and later stercoraceous. The respiration is thoracic, the tongue is dry, and great thirst exists. The pulse, which is slow at first, becomes small and rapid and of high tension. Blood in the stools rarely appears early enough to be of diagnostic value. There may be no marked symptoms for an hour or two or for many hours. The escape of gas into the peritoneal cavity may cause the diminution or disappearance of liver-dulness. After anesthetizing the patient hydrogen gas insufflated into the rectum will come from the mouth if there is no perforation in the stomach or the intestine; if a perforation exists, tympanites is much increased, and the area of liver-dulness may disappear. To apply rectal insufflation of hydrogen, generate the gas in a bottle by means of zinc and sulphuric acid, catch the gas in a large rubber bag, and attach the tube from the gas reservoir to a tip which is inserted in the rectum. Give the patient ether to relax the abdominal muscles, direct an assistant to press the anal margins against the rectal tip, and when the patient is unconscious turn on the stopcock and press upon the reservoir (Senn).

It has been suggested that ether vapor, mixed with air, can be used instead of hydrogen gas.† In this method a little ether is poured into the bottle of an aspirator, the valves are opened, one tube is carried into the rectum, the other tube is attached to a bicycle pump, and by working the pump the ether vapor is driven into the bowel. If there is perforation, tympanites is notably increased. Some surgeons regard the rectal insufflation test as unsatisfactory and often dangerous. Personally I am not inclined to use it. Its application requires considerable time, it must of necessity increase fecal extravasation, and, as Le Conte ‡ says, it "so distends the intestines that

* *Annals of Surgery*, March, 1902.

† Emerson M. Sutton, of Geneva, in *Jour. Am. Med. Assoc.*, July 23, 1898.

‡ *Am. Jour. Med. Sciences*, Dec., 1901.

it may be impossible to return them to the abdominal cavity until they have been emptied of gas."

Treatment of Rupture of Intestine.—If symptoms point to dangerous hemorrhage, operate at once; otherwise do not operate until reaction has been obtained. If in doubt as to whether or not rupture exists, explore. Reaction is brought about as previously directed. Asepticize and anesthetize. Perform a laparotomy; check hemorrhage; find the rent, and close it by Halsted sutures if possible. Because of the frequency of multiple lesions the surgeon must not be sure he has finished his work when he finds and closes one tear, but he must determine by careful search that no other tears exist. The surgeon notes if there is injury of the mesentery and if the circulation of any portion of the bowel is interfered with. If there is serious impairment of circulation in any part of the bowel-wall, perform intestinal resection, followed by end-to-end approximation or lateral anastomosis. Flush the abdominal cavity with hot saline solution, and wipe the peritoneal fossæ and the space between the liver and diaphragm with gauze. Finney eviscerates, wipes out the abdominal cavity, and wipes the intestines as he restores them. Whatever method is used to cleanse the abdomen, remember that infectious material is apt to accumulate between the liver and diaphragm and in Douglas's pouch. Drainage is to be used. The value of operation for intestinal rupture is conclusively demonstrated. Curtis collected 116 cases which occurred before 1887. Not a case was operated upon and every patient died. Homer Gage collected 85 cases since 1887; 45 were not operated upon and every one died; 40 were operated upon and 17 recovered. At least 93 per cent. will die if not operated upon (Eisendrath*).

Identification of the Small Intestine and of the Large Intestine.—

"In abdominal operations it is frequently imperatively necessary that the large intestine be recognized with certainty or the small bowel be positively identified. The size of the tube will not always aid in this recognition, as a small intestine may be distended enormously and a large intestine may be contracted to the size of a finger because of obstruction above. The longitudinal muscular fibers of the large bowel are accentuated in three portions; these accentuations constitute the three longitudinal bands which begin at the cecum and terminate at the end of the sigmoid flexure of the colon. Each band is composed of a number of shorter bands, the shortness of these constituent bands permitting the sacculation of the large intestine. Longitudinal bands and sacculation are not met with in the small gut, their presence or absence being a means of identification in many cases; but when the colon is much distended the bands cannot be seen distinctly and the sacculation disappears. From the large intestine only spring the appendices epiploicæ (small overgrowths of fat in pouches of peritoneum), but they are sometimes not well marked except upon the transverse colon, and when emaciation exists they may almost entirely disappear. The relatively fixed position of the large intestine and the free mobility of the small bowel are important points of distinction. The foregoing indicates that it is not always easy to distinguish between colon and small gut, and that, according to old rules, it may be often necessary to make large incisions, to see as well as

* Jour. Am. Med. Assoc., Oct. 25, 1902.

feel, and to handle a large extent of the bowel. Any scrap of knowledge that will shorten an abdominal operation, that will permit of as certain work through a smaller incision, and that will diminish handling of intraperitoneal structures, tends to increase the chances of recovery. For these reasons the writer suggests a method of bowel-identification which rests upon the facts that each bowel has a posterior attachment, that the origin of the attachment differs according to the bowel it supports, that a single finger can detect the origin of the peritoneal support of any section of the bowel, and, this origin being known, the portion of the bowel it supports is with certainty deducible. In an exploratory operation, for instance, the finger comes in contact with the bowel: to determine whether it is a large or a small bowel, note first if the structure is movable or is firmly flexed; next, pass the finger over the bowel and let it find its way posteriorly. If dealing with a small bowel, the finger will reach the origin of the mesentery between the left side of the second lumbar vertebra and the right sacro-iliac joint; if dealing with the large bowel, the finger will reach the origin of the mesocolon, or the point where the colon is fixed posteriorly and to the side.”*

Rupture of the liver may be caused by a blow, a fall from a height, or the concussion of a railroad collision. Occasionally the ends of fractured ribs are driven into the organ.

The **symptoms** are those previously set forth as attending severe intra-abdominal injury (p. 696). In addition, there are tenderness over the liver, and often pain in the abdomen and back. As a rule, the signs of hemorrhage are present. Sugar may appear in the urine. The respiration is much embarrassed. After a few days the skin may itch and become jaundiced, but this is rare.

In these cases operate at once if hemorrhage is severe; otherwise operate after bringing about reaction. Stop bleeding in the liver by cautery, by suture, or by packing. In a superficial tear introduce sutures of catgut or silk. In a deep tear suture the liver to the belly-wall, pack the wound with gauze, and surround it with gauze. Eisendrath has collected 37 cases of suture of the liver for rupture. Twenty-two of these recovered (59.5 per cent.). The first operation was performed by Willette in 1888. At least 80 per cent. will die without operation.†

Rupture of the Gall-bladder and the Bile-ducts.—Rupture of the gall-bladder or the ducts is most apt to happen from injury when gall-stones exist. Peritonitis, general or local, is almost certain to follow such a rupture. Besides those symptoms common to all severe abdominal injuries, there is often intense jaundice.

Treatment.—Suture the laceration or make a biliary fistula.

Rupture of the Spleen.—The spleen may be dislocated as well as ruptured. Rupture of the spleen is rare without other serious injuries. An enlarged spleen is far more liable to injury than a normal organ. The usual symptoms of abdominal injury are present. In addition, there are pain over the spleen and heart, tenderness over the spleen, and great shortness of breath. Hemorrhage is generally profuse but slow. The splenic blood contains numerous leukocytes and clots rapidly, hence the bleeding is usually

* The author, in *Medical News*, June 9, 1894.

† Eisendrath, *Jour. Am. Med. Assoc.*, Nov. 1, 1902.

arrested for a time, and a patient does not often bleed to death rapidly (Ballance).

Ballance points out that dulness is found in the left loin, but, because of the clotting of the blood, the dulness does not shift when the position of the patient is shifted, as it does in bleeding from other intraperitoneal structures.

Treatment.—Ballance tells us that after a splenic injury there is shock, but after a time there is a distinct reaction. Wait for the reaction, and when it occurs remove the spleen. The mortality in cases not operated upon is probably about the same as in rupture of liver (80 per cent.). In 50 cases operated upon 28, or 56 per cent., recovered (Eisendrath).

Rupture of Mesentery Arteries.—The symptoms are those of hemorrhage. Aldrich* reported a case in which death occurred on the seventh day.

Rupture of the Kidney (page 937).

Rupture of the Ureter (page 939).

Wounds of the Abdominal Wall.—**Non-penetrating wounds** are to be treated on general principles. They are sutured with great care and are firmly supported externally. Ventral hernia may follow a large wound.

Penetrating Wounds.—The *symptoms* of penetrating wounds of the abdominal wall are usually those of shock and hemorrhage, and later of septic peritonitis. Emphysema is apt to occur and viscera may protrude, and often do in the case of a large incised or lacerated wound. Extravasation of contents of intra-abdominal viscera is very apt to occur, and is sure to occur if the viscus was distended when injured. Normal urine and normal bile may do little harm, but if either excretion is septic, disastrous consequences are certain to ensue. If intestinal contents escape, septic peritonitis is certain to occur. Bleeding is usually profuse and prolonged, because spontaneous arrest of hemorrhage from any considerable vessel will rarely take place within the abdomen.

Treatment.—The surgeon endeavors to discover promptly if a wound of the abdominal wall is or is not penetrating in character. This fact may be proved by protrusion of viscera, by the appearance of stomach-contents in the wound, or by a flow of bile, urine, or feces from the wound. If none of the above indications exists, and if there are no signs of serious hemorrhage, the wound should be irrigated with hot salt solution, and should be dressed with gauze, and every effort should be made to bring about reaction.

When reaction is obtained, the wound should be enlarged layer by layer until it becomes obvious whether the peritoneum is open or not. Madelung, of Strassburg, points out that incision layer by layer will be of no use in settling the question of penetration if the wound is in the chest, the buttock, the perineum, or the back of a fat individual.† If after incision layer by layer it becomes evident that penetration has not occurred, the wound should be closed and treated on general principles. If it becomes evident that it has occurred, the abdomen should be opened at the point of penetration, and a thorough exploration of intra-abdominal structures should be made in order to determine the injury and be able to treat it properly.

In a case still doubtful after incision layer by layer, do an exploratory

* Annals of Surgery, March, 1902.

† Annals of Surgery, Sept., 1897.

laparotomy in the middle line. It is impossible to affirm from the appearance of the wound and from the symptoms that visceral injury has not occurred; hence, in every penetrating wound in civil practice perform exploratory laparotomy.

In every case in which it is evident that penetration has occurred laparotomy is necessary in order to detect and correct intra-abdominal injury, and clean the peritoneum by flushing with hot salt solution. If viscera protrude, they must be washed off with hot salt solution and covered with hot sterile pads, and after the patient has reacted the wound should be enlarged, the condition of the contents of the abdomen investigated, hemorrhage arrested, wounds properly treated, and the viscera returned.

It is customary to flush the belly with hot salt solution, some of the fluid being allowed to remain. This proceeding mechanically cleanses the peritoneum, removes blood-clots, and strongly combats shock. It is not absolutely necessary to flush out the belly unless a considerable hemorrhage has occurred or feces or stomach-contents have been extravasated. If extravasation of stomach-contents or feces has occurred, not only should flushing be practised, but evisceration should be carried out; the fouled intestine should be wiped off with gauze pads wet with hot salt solution, and be wrapped in hot moist towels; the peritoneal fossæ should be rubbed with gauze pads and the space between the liver and diaphragm should be carefully wiped.

A wound of the stomach should be sutured; a wound of the bowel may be sutured, or resection and anastomosis or resection and end-to-end suturing may be required. Visceral injuries are treated by appropriate means. In a punctured wound or a gunshot-wound of the intestine, rectal insufflation of hydrogen gas may disclose the nature of the injury, but evisceration may be required.

After the completion of intra-abdominal manipulations the surgeon restores any protruding bowel.

Drainage is required when the contents of the stomach or the intestines have escaped, when hemorrhage is severe, or when the liver, pancreas, kidney, or spleen is found to be damaged. The peritoneum may be sutured with a continuous suture of catgut, and the muscles, fascia, and skin with interrupted sutures of silkworm-gut, or through-and-through sutures of silkworm-gut may be used. Active stimulation and artificial heat are needed immediately after the operation to combat shock. In many cases intravenous infusion of hot normal salt solution is of great value. It may be given both during and after operation. Enteroclysis, or high rectal injection of hot saline fluid, is useful. So is hypodermoclysis, or the subcutaneous injection of hot salt solution. The after-treatment consists of rest, avoidance of food by the stomach for forty-eight hours, and the administration of brandy and water from time to time. For two days the patient should be fed by the rectum. On the appearance of the first sign of peritonitis, forty-eight hours or more after the operation, give a saline cathartic. It is not wise to purge during the first forty-eight hours after the operation, unless a Murphy button was used. When there is no sign of peritonitis, a purge should not be given until the fourth day. After forty-eight hours liquid food can usually be given by the stomach. Solid food may be given after seven or eight days, but the patient must not leave his bed until the wound is firmly united, because of the danger of ventral hernia. A

support should be worn for a long time. E. D. Fenner* reports 39 stab wounds of the abdomen operated upon in the Charity Hospital of New Orleans. There were 9 deaths (23.07 per cent.).

Gunshot=wounds of the Abdomen.—The bullet may penetrate from the front, the side, the back, the chest, or the perineum. If a bullet has penetrated, it may or it may not have produced visceral damage. A pistol-bullet or the bullet of a sporting-rifle usually does; a projectile of a modern military rifle may not or may produce wounds which can be recovered from without operation. A urinary examination should be made promptly to see if blood is present.

In gunshot wounds of the belly shock is usually due to hemorrhage, and in civil practice certainly prompt operation is indicated. The incision is made through the belly even when the shot entered the back. In some cases the opening is made through the wound; in others it is not; but in every case the wound is explored and cleaned. After opening the abdomen our first duty is to arrest hemorrhage, our next is to look for perforations of the viscera and mesentery and close them. If the anterior wall of the stomach is perforated, close the opening and examine the posterior wall through an opening made in the gastro-colic omentum. If a posterior perforation is found, close it and insert posterior drainage into the lesser peritoneal cavity. As a rule, an intestinal perforation can be closed, but occasionally considerable intestine requires resection. If the bullet is encountered it is removed, but a prolonged search for it should never be made. Finally the abdominal cavity is cleansed, drainage is provided for, and the abdominal wound is closed.

E. D. Fenner† reports 113 gunshot-wounds of the abdomen, operated upon in the Charity Hospital of New Orleans; there were 78 deaths (69 per cent.).

Military surgeons have shown that wounds inflicted by the modern hard-jacketed projectile are not so apt to involve fatal hemorrhage and disastrous complications; in fact, such wounds are often recovered from without operation, and sometimes with an entire absence of serious symptoms. Again, it is difficult or impossible to treat such cases as in civil practice, even were it desirable. In fact, in military practice the results are slightly better from expectant treatment, whereas, in civil practice, the reverse is true. Still, even in war, if conditions permit, operation should be performed if there is hemorrhage or obvious visceral injury, or if septic peritonitis develops.

Gunshot=wounds of the Pregnant Uterus.—It is rarely that both walls are perforated, as the force of the bullet is greatly lessened by the uterine contents. As a rule, there is severe shock and hemorrhage, and occasionally amniotic fluid flows from the wound of entrance. The intestine may also be injured. As a rule, labor pains come on soon after the injury. Gellhorn‡ has collected 18 cases. In this series there were 12 recoveries. The proper treatment early in pregnancy, if the wound is small, consists in emptying the uterus and closing the wound. A large wound, or any wound late in pregnancy, demands the Porro operation.

* *Annals of Surgery*, Jan., 1902.

† *Annals of Surgery*, Jan., 1902.

‡ *St. Louis Med. Review*, Dec. 2 and 9, 1901.

STOMACH AND INTESTINES.

Foreign Bodies in the Stomach and Intestine.—Foreign bodies of considerable size are rarely taken into the alimentary canal except by children, insane people, or drunkards. Most foreign bodies swallowed are passed with the feces, but some lodge. Any body which can pass the esophagus is not too large to pass through the intestines. Lodgment is an accident, not an inevitable consequence—an accident which is due to the shape and size of the body. A foreign body may lodge in the stomach. In some cases there are no symptoms. In other cases symptoms are violent. The severity of the symptoms depends upon the shape and character of the body.

In some cases it is possible to feel the body from without. A metal body in the stomach will deflect a magnetic needle held over the viscus (Polaillon). Many foreign bodies can be skiagraphed. It is not wise to attempt to recover the body by inducing vomiting. In some cases gastrotomy is necessary. When a foreign body has been swallowed, the usual treatment is as follows: a purgative should *never* be given to expedite the passage of a foreign body, because increased peristalsis means increased danger of impaction or of perforation. Endeavor to encrust the foreign body, and thus lessen the danger of perforation, by feeding with bread and milk only for several days, and at the end of this period give a mild laxative. An exclusive diet of mush or of mashed potatoes has been suggested. Pain is relieved by opium. A foreign body rarely lodges in the duodenum, but may lodge lower down, and may cause ulceration, perforation, abscess, or intestinal obstruction. Operation may be necessary in such cases.

Carcinoma of the Stomach.—Innocent tumors and sarcomata occasionally attack the stomach, but they are infinitely rare in comparison with primary cancer. This disease is unusual before the age of forty and is practically never seen before the age of thirty. It is more common in men than in women, the proportion being as 5 to 4. In a very few instances cancer has been found to have arisen from an ulcer. The forms of cancer met with, set forth in their order of frequency, are, according to Osler, epithelioma, encephaloid, scirrhus, and colloid. Cancer may be limited to the body of the stomach (either curvature or either wall), the pyloric end, or the cardiac end; but it may involve two of these regions, or almost the entire stomach, or, being multiple, may be found in many parts. It is usually fatal in from four months to two years, and most patients die within one year. In 60 per cent. of cases the pylorus is involved. In over half of the cases of cancer of the pylorus there is no important lymphatic involvement (McArdle). In investigating any gastric disorder, follow Mayo's advice, and study the history, the size and situation of the stomach, determine the existence and situation of pain and tenderness, the presence of a tumor, and if the passage of food is interfered with.

Symptoms.—Examine with care a patient in whom cancer is suspected. In unusual cases it produces no symptoms until it has lasted for some time and has attained a large size. In nearly all cases it does produce symptoms. The disease comes on gradually, usually with indigestion and physical weakness. The patient has persistent dragging pain, which is increased by eating and pressure, and attacks of vomiting are frequent. After a short time the

patient becomes very weak and excessively anemic, and it is often possible to feel a tumor in the stomach. Blood examination shows diminution of red corpuscles and hemoglobin, and absence of any increase of leukocytes after a full meal. The vomiting of gastric cancer is at first only occasional, but as the case progresses it becomes more and more frequent. Vomiting soon after eating occurs when the cardiac region is involved; vomiting an hour or so after eating occurs when the pyloric end is involved. When the body of the organ is the seat of disease, vomiting may be absent. The vomited matter is often mixed with a small amount of altered blood (coffee-ground vomit). In most cases free hydrochloric acid is not found in the stomach, but lactic acid is found and Oppler's bacillus can often be detected. If the cancer is not ulcerated, free hydrochloric acid will probably be found; if it is ulcerated, it will usually be absent.* Free hydrochloric acid may be absent from the stomach because of atrophy of glands, cessation of secretion, or neutralization by the products of the cancerous area. Free hydrochloric acid may be absent when cancer does not exist. I have noted its absence in two cases of cicatricial stenosis of the pylorus.

Distend the stomach with gas or fluid and map out its outlines. Feel for a tumor. A tumor can usually be felt if it involves the greater curvature, or anterior wall, and a large tumor of the pylorus can be palpated, but in other regions the tumor can rarely be felt. Give a test-meal, siphon off the contents of the stomach, and examine for free hydrochloric acid, lactic acid, and Oppler's bacilli. Ewald's test-breakfast is usually employed. It consists of a dry roll and three-fourths of a pint of weak tea or warm water. It is given on an empty stomach. After an hour the stomach-tube is introduced. The fluid is removed by a pump or by abdominal compression.

Cancer of the cardiac end interferes with the entrance of food into the stomach, and in such a case the stomach is shrunken and the esophagus is dilated immediately above the growth. In cancer of the pylorus the food is partially or completely arrested as it passes to emerge from the stomach, and the stomach becomes much dilated. The vomited matter in a case of cancer rarely contains recognizable fragments of the growth, but fluid with which the stomach has been irrigated may contain pieces which can be identified as cancer (Rosenbach).

In cancer of the stomach the general course of the temperature is normal, but there are occasional deviations to below or above normal. In many cases the urine contains albumin, indican, acetone, and casts. Occasionally cancer of the stomach produces spasm of the esophagus. I have seen this in two cases. Cancer of the stomach is apt to involve secondarily adjacent lymph-glands, or organs or other structures, especially the liver; in fact, the liver is involved in 30 per cent. of the cases (Welch). Occasionally there is enlargement of the supraclavicular glands of the left side. Metastases are usual and early, but in cancer of the pylorus over half the cases show no distinct lymphatic involvement. In many doubtful cases exploratory incision is justifiable.

Treatment.—The *medical* treatment consists in milk-diet, and the use of morphin and of *lavage* if the pylorus or body of the stomach is diseased. Perform lavage as follows: The tube for lavage should be long enough to extend

* Reissner, in München. med. Woch., Dec. 3, 1901.

about three feet out of the mouth when the other end is in the stomach, it should be flexible, should have an opening in the stomach-end and another opening on the side about one inch above the stomach-end. The tube should be greased with glycerin. The patient sits down, throws the head back, opens the mouth widely, and is directed to take deep breaths at regular intervals. The tube is carried into the pharynx, the patient is ordered to make efforts to swallow it, and the tube is thus taken into the stomach. About one quart of fluid is poured into the funnel-like end of the tube, and just before the tube empties itself of the last of the water the funnel is lowered and the fluid runs out. This proceeding is repeated till the fluid becomes clear. The best fluid to use is a solution of bicarbonate of sodium, a teaspoonful of the salt to a quart of warm water. Lavage should be practised before breakfast, and sometimes also at bed-time.

The *indications for operation* are well set forth by Macdonald: They are progressive aggravation of symptoms in spite of a rigid diet and medical treatment, loss of gastric mobility, progressive diminution of gastric peristalsis, progressive diminution of free hydrochloric acid, emaciation even under forced feeding, progressive reduction of hemoglobin to 65 per cent. or under, and moderate leukocytosis.*

Surgical treatment aims to remove the growth, or to obviate the effect of obstruction at one of the orifices of the stomach.

In cancer of the body of the stomach, if the growth is not extensive, excision may be performed; if it is extensive, it is useless to attempt it unless the growth is absolutely non-adherent. Schlatter, of Zürich; Brigham, of San Francisco; Richardson, of Boston; Macdonald, of San Francisco; Boeckel, of France; and De Carvalho, of Brazil, and others have successfully removed the entire stomach and attached the esophagus to the small intestine. In these cases digestion was satisfactorily performed after removal of the stomach. Very rarely will cases be found suitable for such a radical proceeding. The case suitable for this treatment is one in which the entire stomach is involved in the growth, in which there is no obvious glandular involvement, and in which the stomach is not adherent but is freely movable. In limited cancer of the body of the stomach perform partial gastrectomy. In cancer of the cardiac orifice of the stomach the surgeon usually keeps the passage open as long as possible by the frequent passage of a tube, and through this tube introduces liquid food. Sometimes a small tube is introduced and permanently retained. When it becomes difficult to introduce a tube, gastrostomy may be performed. As a matter of fact, in most cases gastrostomy is done as a last resort, and it is scarcely worth doing in cancer of the cardiac end of the stomach. It is far more useful in cancer of the esophagus. In cancer of the pylorus limited in extent and without lymphatic involvement, pylorotomy may be performed; but in cancer which has widely infiltrated the coats of the stomach and has involved the lymphatic glands, gastro-enterostomy is performed as a palliative measure, the patient during the rest of his life subsisting upon liquid or semiliquid foods and submitting to frequent irrigation of the stomach to remove food-residue. In cases of irremovable cancer it is usually best to create the opium-habit.

The most successful of all the above operations is pylorotomy or partial

* John B. Murphy, in Chicago Med. Recorder, June 15, 1902.

gastrectomy. There are in literature 43 cases which have survived three years or over (Macdonald). Mayo reported 21 gastro-enterostomies for cancer with 4 deaths. The greatest prolongation of life was nineteen months. His experience makes him question if the operation is worth doing in malignant disease.

Sarcoma of the Stomach.—Of recent years it has been proved that sarcoma is more common than was once supposed. There are over 60 cases on record. It can occur at any age, but is more usual in early life than is carcinoma. It has been estimated by Wm. T. Howard * that 37.7 per cent. of cases are under the age of forty, and 11.44 per cent. are under the age of twenty. The pylorus is involved in about one-fourth of the cases. In most cases the posterior wall and greater curvature are involved. Howard says there is a diffuse growth in 21.31 per cent. of cases and that the cardiac end is involved in only 4.9 per cent. of cases. Sarcoma arises in the submucous coat. Any form of sarcoma may arise. It causes stenosis in less than one-tenth of the cases. There is no sex predisposition in sarcoma, as there is in cancer.

Symptoms.—A tumor forms, grows rapidly, and often attains a large size, and not unusually actually causes a projection of the abdominal wall. If it ulcerates, there will be hematemesis, but it often does not ulcerate, and bleeding is much rarer than in carcinoma. Not unusually this growth arises in a person under forty, and sometimes in one of less than twenty years of age. Stenosis is uncommon. The liver is involved secondarily in only 11.47 per cent. of cases (Howard), metastases are more rare than in carcinoma, free hydrochloric acid is usually absent from the gastric contents, and microscopic examination of washings from the stomach may detect fragments of sarcoma. Certain diagnosis is impossible without exploratory incision. Howard estimates the average duration of life to be from nine to ten months.

Treatment.—If the liver is free and if there are no metastases, partial gastrectomy or complete gastrectomy may be advisable. If there is pyloric stenosis, gastro-enterostomy may be performed.

Peptic Ulcer of the Stomach.—Ulcer of the stomach is a condition due to digestion of a portion of the stomach-wall by very acid gastric juice, the destroyed portion having been the seat of lowered vitality. The reason for the lowered vitality of the gastric mucous membrane is uncertain. Thrombosis has been suggested as a cause, but it is rare in gastric ulcer. Embolism is assigned by some as a cause, but emboli are seldom found by pathologic examination. Some observers blame infection; others direct damage to the mucous membrane, but the question is involved in uncertainty. What does seem to be certain is that anemia strongly predisposes to the formation of very acid gastric juice (hyperchlorhydria) and to ulceration.

Ulcers are more common in females than in males, and are more frequent in young women than in those of middle or advanced age. Men about forty and women between twenty and thirty are particularly liable. There is usually a single ulcer, but in some cases there are two or more. The ulcer may heal or may perforate. The most common seats of ulcer are the posterior wall and lesser curvature, especially in the pyloric region. Only 2 per cent. of ulcers on the posterior wall perforate, as they tend to form adhesions to adjacent struc-

* Jour. Am. Med. Assoc., Feb. 8, 1902.

tures (Alderson). Ulcers on the anterior wall are unusual, do not tend to form adhesions, and are apt to perforate. Disorder of menstruation may develop ulcer, so may tight lacing, and habitually bending over, as in making shoes. Chlorosis is associated with ulcer in many cases. Traumatism and swallowing corrosive liquid may lead to ulceration. Alderson believes that alcoholism, syphilis, and mental anxiety may lead to the condition. Ulcers due to syphilis and tubercle are not, be it remembered, peptic ulcers.

Symptoms.—Acid dyspepsia exists, associated with much flatulence. In most cases, though not in all, food aggravates the condition. In many of these patients vomiting occurs about two hours after eating. The vomited matter contains much hydrochloric acid. Hemorrhage from the stomach occurs in about one-half of the cases. The blood may be brought up with food, and is then black and clotted, or may be vomited clear and in large amount. In hemorrhage from an acute ulcer a pint or two may be ejected in a few minutes, and such a patient presents all of the general symptoms of dangerous hemorrhage. In some cases blood from the stomach is passed by the bowels in part or wholly. A very large hemorrhage may occur, and yet the bleeding never be repeated, or a large hemorrhage may be followed by another or be the first of three or of a series. In a great many cases after a large hemorrhage there is no further bleeding or there are subsequently a few small hemorrhages. Small hemorrhage may recur indefinitely and may after a time eventuate in a large hemorrhage. In chronic small hemorrhages recurring over a long period the condition is due to the erosion of small vessels which cannot contract and retract because they are imbedded in fibrous tissue. A large hemorrhage may be due to the erosion of a large vessel, but is often produced by the existence of a great number of erosions of the mucous membrane, erosions perhaps so numerous that blood seems to pour from every portion of mucous surface. In a sudden acute, violent hemorrhage there will probably be no history of antecedent stomach trouble. In ulcer paroxysmal pain exists, which is usually, but not invariably, aggravated by taking food. The pain is very violent in the abdomen, and also passes to the back, being located between the eighth and ninth dorsal vertebrae.

In gastric ulcer it is usual to find tenderness developed by abdominal pressure.

If the ulcer does not cicatrize, but progresses, causing pain and hemorrhage, the patient becomes thinner, more anemic, weak, and even exhausted.

It is certain that many cases of gastric ulcer are unrecognized; in fact, as Habershon says, diagnosis is rarely made unless hemorrhage exists, and in certain latent cases both vomiting and bleeding are absent. It is believed that latent ulcers are even more common than are ulcers causing symptoms.

A gastric ulcer may cicatrize and thus be cured, but the cure of the ulcer may prove the ruin of the stomach by producing stenosis of one of the stomach-orifices or hour-glass contraction of the body of the stomach. An ulcer may perforate. A perforation may be acute; that is, the ulcer suddenly breaks open when the stomach contains food or liquid, and the contents of the stomach are poured into the free peritoneal cavity. If a perforation occurs when the stomach is empty or nearly empty, there is no escape of stomach-contents or the escape of only a small amount, and the opening may be quickly closed by adhesions or by a piece of omentum. In what is known

as a chronic perforation the break takes place into a box of preformed adhesions, the extruded gastric contents are circumscribed by these adhesions, the general peritoneal cavity is not invaded, but circumscribed suppuration is inaugurated.*

Perforation is usually brought about by muscular effort and is most common after a full meal. "The severity of the symptoms depends upon several conditions: the previous state of health, the size and number of the perforations, the condition of the stomach, whether full or almost empty, the bacterial virulence of its contents, and the occurrence of vomiting."† The situation of the ulcer has some influence on the symptoms. "If in the fundus, at the cardiac end, or in the body of the stomach, an acute infection of the whole peritoneal cavity rapidly follows; if the ulcer be at the pylorus or in the first portion of the duodenum, the fluid is directed down the right side of the abdomen, owing to the hillock formed by the transverse mesocolon at the pyloric end of the stomach" (Moynihan). In such a case the fluid may gravitate toward the right iliac region and the condition may be mistaken for appendicitis. In one such case I operated, believing that appendicitis existed. Alderson calls attention to the fact that the sudden perforation of an ulcer may be mistaken for poisoning, and he cites the death of the Duchess of Orleans in 1670.

Acute perforation can usually be certainly diagnosed if the case is seen early. Perforation causes sudden and violent epigastric pain, greatly increased by swallowing fluids, by vomiting, and by pressure. This pain may radiate throughout the abdomen, but the chief tenderness is in the region of the stomach. The collapse is usually profound. In some cases death takes place quickly, but as a rule reaction occurs and peritonitis develops. Vomiting is rare after rupture. When it does occur, it does much harm by increasing shock and by ejecting gastric contents into the peritoneal cavity. Vomiting of blood is very unusual. Rigidity exists and it is most marked in the upper portion of the abdomen. The area of liver-dulness is in many cases diminished or obliterated. Such an emergency has usually but not invariably been preceded by positive and prolonged symptoms of gastric disorder.

Treatment.—*Medical Treatment of Non-perforated Ulcer.*—Rest in bed. Rectal feeding for a time, followed by the use of a bland diet. Lavage twice a day. To some cases Carlsbad salts are given (Ziemssen), to others silver nitrate, bismuth subnitrate, or oxalate of cerium. If pain is severe, opium is required.

Surgical.—In a chronic ulcer if the patient grows worse in spite of careful dietetic and medical treatment, if hemorrhage has been profuse or if there have been frequent distinct hemorrhages, if the pain is violent, or if tenderness is marked, open the abdomen and inspect the stomach. An ulcer may be removed by an elliptical incision in the long axis of the stomach, the coats being sutured by the usual method. I have extirpated one chronic ulcer with satisfactory results. In some cases gastro-enterostomy leads to the cure of chronic ulcer. In an acute and violent hemorrhage threatening life the proper course to pursue is somewhat uncertain. It is not proper to operate for one hemorrhage, because the chances are it will not be repeated. Again, the chance of

* See paper by B. G. A. Moynihan, Brit. Med. Jour., Jan. 31, 1903.

† Moynihan, in Brit. Med. Jour., Jan. 31, 1903.

‡ Provincial Med. Jour., Dec. 2, 1895.

arresting such a hemorrhage by operation is, on the whole, poor. If the bleeding is from a distinct ulcer, we may succeed in excising or in ligating. As a rule, however, the bleeding is not from a distinct point but from a multitude of excoriations. In the light of our present knowledge we may lay down the following rule: Do not operate for one acute hemorrhage. Simply bring about reaction by gentle means, let the patient take bits of ice, and give suprarenal extract by the stomach. If the bleeding recurs once or twice in comparatively trivial amounts, do not operate; but if it recurs violently, we should advise operation. The surgeon opens the abdomen while hot salt solution is being thrown into a vein. The stomach is opened, the clot washed out, and a search made for the source of the blood. If it is found that the blood comes from an area of ulceration, this area should be extirpated or ligated. If it is found that the bleeding comes from a multitude of excoriations and that the stomach is, as Moynihan expresses it, "weeping blood," we can do nothing but gastro-enterostomy, which in such a condition is of uncertain value. In perforation bring about reaction from shock and open the abdomen. When the abdomen is opened, there is an escape of odorless gas, and food or fluid may be discovered in the peritoneal cavity. The perforation is sought for and some surgeons recommend excision. I do not believe that excision is necessary. The ulcer should be buried or overlaid with stomach-wall by two layers of Halsted sutures. The abdominal cavity is irrigated with hot salt solution and the space between the liver and diaphragm is sponged out with a gauze pad wet with hot salt solution. If the case is operated many hours after the perforation, or if the peritoneum was badly soiled, drainage must be used, but even in other cases it safest to use it. Of late a number of cases have been successfully operated upon. Moynihan estimates that 35-40 per cent. of acute perforations recover after operation.

Cicatricial stenosis of the orifices of the stomach results from the healing of an ulcer, the swallowing of a corrosive substance, or traumatism from a foreign body. Constriction of the *cardiac orifice* is indicated by gradually increasing difficulty in swallowing. After a time the esophagus above the stricture dilates or pouches; the fluid food passes into the stomach, but the solid food lodges in the esophageal pouch and is soon regurgitated. The site of the stricture is located by a bougie, and by having the patient swallow while auscultating over the esophagus and cardiac end of the stomach. If the constriction be malignant, the patient will be found to be beyond middle life, the vomit is occasionally bloody, emaciation is rapid and decided, and occasionally the supraclavicular glands are enlarged. A tumor of the cardiac end of the stomach can seldom be palpated. If the constriction be cicatricial, the history will indicate the cause. Constriction of the *pyloric orifice* causes retention of food and dilatation of the stomach. Dyspeptic symptoms will be found to have been long present. A tube passed into the stomach permits of the injection of fluid so as to fill the stomach. When the fluid runs out it contains portions of undigested food, which was perhaps eaten days before, and measurement of the liquid shows that the capacity of the stomach is enormously increased. If hydrogen be forced through the tube, the outline of the distended stomach is at once made clear. The usual method of distending the stomach is by a Seidlitz powder: two solutions are made; the bicarbonate solution is swallowed at once, and the tartaric solution is taken afterward in small

amounts at a time. Percussion over the distended stomach indicates the size of the viscus.

In malignant disease of the pylorus a tumor may often be made out; there are tenderness and considerable persistent pain, great cachexia and emaciation, absence of free hydrochloric acid from the gastric juice, diminution of red corpuscles and hemoglobin, and no increase of white corpuscles after a full meal. There is sometimes enlargement of the supraclavicular glands. Vomiting of bloody fluid occurs in 40 per cent. of cases. Illumination of the stomach by the gastrodiaphanoscope may aid the diagnosis, the area of malignant growth interfering with the transmission of light. In cicatricial stenosis of the pylorus there may be paroxysms of pain, there is no tenderness, emaciation is not so rapid in onset, and the supraclavicular glands are never enlarged. Vomiting occurs, but the ejected matter is not bloody.

Treatment.—Cicatricial cardiac stenosis requires dilatation with bougies and the maintenance of the restored caliber. If dilatation from above is unsatisfactory, perform a gastrotomy, push a small bougie from the mouth into the stomach, tie a string to the bougie, draw the string through the stricture, use the string as a saw to cut the fibrous bands, pass a full-sized bougie, close the wound in the stomach, and maintain the caliber of the cardiac orifice by the repeated passage of dilating instruments. If no instrument can be passed through the stricture from above, perform a gastrotomy, introduce an instrument from below and pass it into the mouth, tie a string to it, draw the string into the stomach, and use Abbe's string-saw. If no instrument can be passed from below, convert the gastrotomy into a gastrostomy. In malignant stenosis of the cardia gastrotomy, if performed at all, should be performed early. Cicatricial pyloric stenosis was once treated by a gastrotomy and digital divulsion of the stricture (Loreta's operation); but this operation is obsolete, experience having shown that recontraction is inevitable. Pyloroplasty is advocated by many surgeons. This is known as the Heineke-Mikulicz operation. Occasionally the symptoms are not relieved by pyloroplasty, a condition which renders gastro-enterostomy necessary. Mayo points out that in such cases pyloroplasty fails because the pylorus is on a higher level than the gastric pouch and the degenerated muscle of the stomach is unable to lift the food from the pouch to the pylorus and the symptoms of gastric dilatation and retardation of the passage of food into the duodenum are not relieved. Gastro-enterostomy is a very satisfactory operation, and usually effects a cure. Malignant stenosis is treated by pylorectomy or gastro-enterostomy. (See under these heads respectively.)

Perigastric Adhesions.—That perigastric adhesions are frequently responsible for stomach pain and digestive difficulty is undoubted. Such adhesions often arise in cases of protracted ulceration of the stomach or duodenum. A common cause of perigastric adhesions is gall-stone disease. Tuberculous peritonitis causes dense adhesions. In some cases the adhesions are traumatic, in some are due to syphilis, in many the cause is uncertain (Fred. D. Bird, "Intercolonial Med. Jour. of Australasia," Dec. 20, 1900). Adhesions may cause blocking or kinking of the pylorus, or may glue the stomach to the parietal peritoneum or to some adjacent viscus. In Fenwick's table of 123 cases, he finds that the adhesions usually cause the stomach to

adhere to the pancreas or to the liver. The formation of adhesions in cases of gastric ulcer is, in many instances, conservative, serving to prevent perforation or to prevent extravasation if perforation of the stomach-wall occurs.

Symptoms.—The symptoms are variable. In some cases the adhesions produce little or no trouble; but in the majority of cases they cause definite symptoms, and sometimes the condition becomes one of absolute disablement. The symptoms may be due to blocking of the pylorus, a condition that is followed by gastric dilatation. They may be due to dragging upon the adhesions, when the stomach contracts during digestion, or when peristalsis occurs in an adherent piece of intestine.

The usual symptom is pain, frequently of a violent character. The pain comes on in paroxysms, and recurs over and over again, it may be for years. H. Hale White* points out that in these cases there is usually some pain persisting, which is now and then increased into violent paroxysms; and that the only other condition that produces persistent pain with violent exacerbations is cancer. In adhesion-dyspepsia, however, there is no distinct loss of weight; the condition may exist in youth, as well as in middle age or old age; it is not increased by taking food; and it very rarely causes death. If there is a history of antecedent gall-stone disease or of ulcer of the stomach, it is possible to make the diagnosis without exploratory operation. Even in other cases, the condition may sometimes be diagnosed; because, although there are these attacks of violent pain, there is no tenderness. In rare cases, the adhering and matting together with inflammatory exudate produces a palpable mass. In doubtful cases of chronic and disabling stomach-disease, an exploratory operation should be performed; if adhesions exist, they will then become manifest.

Treatment.—In some cases, simply dividing an adhesion effects a cure; in other cases, it is necessary to make extensive separation of adherent structures, covering the raw surface with omental grafts. In serious adhesions about the pylorus, gastro-enterostomy is usually the proper operation.

Bilocular Stomach (Hour-glass Stomach).—Some few cases are congenital, but the majority are acquired and result from adhesions produced by the healing of an ulcer. In hour-glass stomach with a large opening between the two sacs there may be no symptoms. When the opening is small, the symptoms resemble those of pyloric stenosis. The sac toward the cardia is frequently much dilated. G. G. Cumston† points out that in a congenital bilocular stomach an ulcer is apt to form at the seat of constriction.

Symptoms.—The diagnosis of cancer is often made. The protracted chronic gastritis has caused free hydrochloric acid to disappear and acids of fermentation are usually found. The patient vomits from time to time, bringing up food which was eaten a day or two before, proof that food is retained in the stomach and not digested. Occasionally blood is vomited. There is pain and the patient is harassed with foul-smelling eructations. Emaciation is pronounced. Cumston points out that in a thin belly distention of the stomach may make the condition evident; further, that if water is thrown into the stomach only a part returns, and when the stomach is emptied as much as possible by a tube a splashing sound can still be elicited

* Lancet, Nov. 30, 1901.

† Med. News, Dec. 7, 1901.

in the stomach because the pyloric pouch is not empty. One cause of death is torsion on the axis.*

Treatment.—The diagnosis becomes certain only after exploratory operation, and exploration also enables the surgeon to decide with certainty as to what operation should be performed. Cumston gives us the following suggestions:

1. In rare cases resect the stricture and suture the pouches.
2. If there is trivial ulceration or a slight scar, do an operation upon the constriction exactly similar to pyloroplasty.
3. The best operation in most cases is gastro-gastrostomy—that is, anastomosis of the cardiac pouch to the pyloric pouch; but this cannot be done if the pyloric pouch is small. Then do gastro-enterostomy.

Other operations are:

4. Gastro-duodenostomy.
5. Gastro-jejunostomy.
6. Gastrolisis.†

Chronic Dilatation of the Stomach.—A dilated stomach, roughly speaking, is one which can contain more than 1.5 quarts (Ewald). Some few cases of dilatation result directly from atrophy of the muscular coat, brought about by drinking quantities of liquid, especially beer; chronic catarrh of the stomach; and conditions such as cancer, tuberculosis, diabetes, etc. The common cause of dilatation is constriction of the pylorus. In order to force food by the pyloric narrowing more force is necessary than is required in a normal state of affairs and the stomach muscle hypertrophies. This muscular hypertrophy is compensatory, and dilatation does not occur so long as the muscle is efficient. But finally the pyloric opening becomes so narrow that compensation fails, the stomach-contents accumulate, and the stomach dilates.

Symptoms of Dilated Stomach.—There is annoying hunger unless cancer exists. Thirst is complained of. At intervals of a day or two the patient vomits enormous quantities, and portions of food may be identified which were eaten several days before. The vomited matter is sour and foul-smelling, contains numbers of yeasts and much fermentative acid, but rarely free hydrochloric acid. In some cases vomiting occurs two or three hours after each meal. The patient suffers from foul gaseous eructations. There are progressive emaciation, constipation, scantiness of urine; sometimes cramp in the legs, belly, and arms; tetany may occur, insomnia is the rule, cardiac palpitation occurs, and there is dyspnea, particularly at night.

Physical Signs of Dilated Stomach.—The epigastric region is hollow and the left side of the abdomen is more prominent than the right. The outline of the greater curvature of the stomach can be distinguished. If the stomach contains air, percussion gives a tympanitic note; if it contains fluid, a dull note. When it is partly full of fluid, by altering the position of the patient we can show by percussion that the fluid changes its position. In a doubtful case give a light meal in the evening, and in the morning, before the patient has eaten, introduce a tube and remove any material contained in the stomach. The presence of undigested food points to dilatation.

* Cumston, in *Med. News*, Dec. 7, 1901.

† *Med. News*, Dec. 7, 1901.

The motor power of the stomach can be tested as follows:

Klemperer's Test.—Wash out the stomach. Introduce 100 c.c. of olive oil by means of the tube. After two hours withdraw the oil. The stomach cannot absorb oil, and if the amount withdrawn is subtracted from the amount introduced, the difference is the amount which passed the pylorus. If the condition is normal, not more than from 20 to 40 c.c. should be found in the stomach after two hours.

The Salol Test of Ewald.—Salol is not decomposed in the stomach, but in the intestine is broken up into phenol and salicylic acid. Salicylic acid is absorbed and salicyluric acid soon appears in the urine. If salol cannot reach the intestine, salicyluric acid will not appear in the urine. If salol reaches the intestine more slowly than normal, salicyluric acid will appear after a longer interval than when there is no pyloric block to retard the emptying of the stomach. In a normal person salicyluric acid is found in the urine in from three-fourths of an hour to an hour after swallowing a dose of salol. In stenosis of the pylorus it appears much later. The test is made as follows: The bladder is emptied and the patient is given three capsules, each containing gr. v of salol. The patient is directed to pass water every half hour until he has done so four times. Each sample voided is examined for salicyluric acid by adding neutral chlorid of iron. If salicyluric acid is present, a violet color is noted.

To Test the Absorptive Power of the Stomach.—The absorptive power of the stomach can be tested by giving the patient a capsule containing gr. $1\frac{1}{2}$ of iodid of potassium. Normally it should be found in the saliva in from ten to fifteen minutes. When absorption is deficient, it may not appear for an hour or longer. In order to test for it, moisten starch paper with saliva and touch the moist paper with a drop of fuming nitric acid. If iodine is present, a blue color develops.

While the diagnosis of dilatation of the stomach can be certainly made, the determination of the cause may require an exploratory operation.

Treatment.—Cases not due to pyloric obstruction are much improved by lavage, regulated diet, use of an abdominal belt, electricity, aperients, and other agents called for by symptoms.

In all cases where there is pyloric obstruction, in many doubtful cases, and in cases in which medical treatment fails, exploratory operation is indicated. In dilatation without pyloric obstruction some surgeons advocate gastroplication. If pyloric obstruction exists the surgeon may elect to do pylorotomy, pyloroplasty, or gastro-enterostomy, the method selected depending on the condition discovered. If gastropexy exists, gastropexy or Beyea's operation may be performed.

Acute Dilatation of the Stomach.—This condition may arise in the course of chronic dilatation or when no previous dilatation existed. The cause is uncertain. It is said to be due to degeneration of the gastric muscle in the course of specific fevers, to paresis arising in the course of chronic gastritis, and to the drinking of a quantity of effervescing liquid. The surgeon sees it from kinking or sudden blocking of the pylorus or duodenum—in the course of sepsis and during shock. It is occasionally a fatal sequence of abdominal operations, particularly operations upon the gall-bladder and bile-ducts.

Symptoms.—There is the sudden onset of violent vomiting, pain, frequently cyanosis, the same physical signs met with in chronic dilatation and collapse. Death occurs in most cases.

Treatment.—Wash out the stomach at frequent intervals, give no food by the mouth, and combat shock and sepsis by proper methods.

Gastropptosis.—In this condition the stomach has undergone displacement downward, the greater curvature in many cases being but little above the pubic symphysis and the lesser curvature being between the ensiform cartilage and the umbilicus. This condition is far more common in women than in men, and is especially common in women who have had many children. It may be produced by tight lacing and may follow mobility of the right kidney, of the liver, or of the spleen. It is often associated with enteroptosis and is particularly prone to arise in the anemic and tuberculous.

Symptoms.—There may be no symptoms for a long time, but sooner or later dyspepsia arises because the stomach cannot empty itself. The stomach becomes atonic, its secretions are scanty and altered, and while the viscus may be normal in size or even shrunken, it is usually dilated. The malposition can be made out by percussion when the stomach is distended with air or with fluid.

Treatment.—Lavage, regulation of diet, improvement of the general health, and the wearing of an abdominal binder. If medical treatment fails and the condition is producing grave impairment of the general health, perform gastropexy or Beyer's operation.

Intestinal Obstruction (Ileus or Enterostenosis).—Intestinal obstruction is a condition in which fecal movement is mechanically impeded or prevented. It may be either *partial* or *complete*. *Acute obstruction* is due to a sudden narrowing or occlusion of the lumen of a portion of the intestine. *Chronic obstruction* is due to a gradual narrowing of the lumen of a portion of the intestine, and it may at any time become acute. If obstruction to circulation in the wall of the bowel occurs, the condition becomes one of strangulation. Intestinal obstructions are classified* as follows:

1. *Strangulation by bands or in apertures*, the commonest form, is due to peritoneal adhesions, but the band may come from the omentum. Obstruction may take place by *Meckel's diverticulum*, a structure due to persistence of the vitelline or omphalomesenteric duct, and coming off from the ileum from twelve to thirty-six inches above the ileocecal valve. The vitelline duct should be obliterated in the eighth week of fetal life. A Meckel's diverticulum usually has no mesentery, is from 3 to 10 inches long, and arises from the convex side of the gut. It may hang free or may be attached to the umbilicus by its tip or by a fibrous cord formed by the obliterated tip. In some cases it remains open at the umbilicus (page 719). In other cases a cord runs from the umbilicus to the gut or the tip of the diverticulum or is adherent to another portion of the intestine. The diverticulum may become strangulated, may enter a hernial sac, may ulcerate or perforate like an appendix (W. Sheen, in "Bristol Medico-Chir. Jour.," Dec., 1901, gives an admirable account of "Some Surgical Aspects of Meckel's Diverticulum"). Strangulation of the diverticulum may take place beneath an adherent ap-

* After Treves, in "Heath's Dictionary."

pendix, a Fallopian tube, a portion of mesentery, or the pedicle of an ovarian tumor, or it may take place in an omental or a mesenteric aperture. Strangulation by bands or in apertures usually involves the ileum, and sometimes the colon. This form of obstruction is identical with hernia, except in the absence of an external protrusion.

2. *Volvulus*, or twisting of the bowel. The twist may be about the mesenteric axis or on the axis of the bowel itself, or two intestinal coils may be twisted together. Volvulus is commonest in the sigmoid flexure. It may occur in a hernial sac.

3. *Intussusception* is the invagination of a portion of bowel-wall into the lumen of an adjacent part. One-third of all cases of obstruction are due to this cause (Treves). Most cases of obstruction in children are due to intussusception. Pitt reports that in St. Thomas's Hospital, from 1875 to 1900 inclusive, there were 115 cases of intussusception, and every patient was under fifty years of age. Gibbon's patient was fifty-eight. Rutherford Morrison had a case due to polypus, and the patient was sixty-two years of age. There are four varieties: the *ileocecal*, in which the ileum and the ileocecal valve pass into the cecum and colon; the *colic*, in which the large intestine is prolapsed into itself; the *ileal*, in which the small intestine alone is involved; and the *ileocolic*, in which the ileum prolapses through the ileocecal valve. The first variety is the commonest. Intussusception is due to active peristalsis.

4. *Stricture of the intestine*, which may be either cicatricial or cancerous.

5. *Obstruction by Tumors of the Bowel and by Foreign Bodies*.—Tumors may be innocent or malignant. Foreign bodies include, besides certain substances that have been swallowed, gall-stones, and enteroliths or intestinal calculi. Foreign bodies are apt to lodge in the lower portion of the ileum or in the cecum, and they may cause ulceration at the seat of lodgment. If a gall-stone is sufficiently large to cause obstruction, it cannot have passed the duct, but must have ulcerated into the bowel from the gall-bladder. About three-fourths of the cases of gall-stone intestinal obstruction occur in women. The stone is arrested at some point, because a local paralysis of the bowel has developed.

6. *Obstruction by tumors, etc., outside the bowel*, among the causes of which are retroflexion or retroversion of the womb, especially in pregnancy, cysts or tumors of the kidneys, ovaries, uterus, etc., movable kidney, and enlarged spleen. Obstruction from any of the above causes takes place in the rectum or the sigmoid flexure.

7. *Obstruction from fecal accumulation* is due to paresis or paralysis of the bowel and the diminution or abolition of peristalsis. Obstruction may follow an abdominal operation. Paresis or paralysis arises in the colon. Treves mentions among the rare forms of obstruction kinking of the bowel, adhesions matting the bowels together or compressing the gut, and shrinking of the mesentery.

In addition to the seven groups previously mentioned, we should consider *post-operative intestinal obstruction and obstruction from embolism or thrombosis of the mesenteric vessels*. Obstruction of the mesenteric vessels is liable to occur when the aorta is atheromatous, and usually causes gangrene of the intestine.

Symptoms of Acute Obstruction.—Severe colic comes on suddenly, the pain varying in intensity, but at no time entirely ceasing. In a suddenly arising intraperitoneal accident, whether it be perforation, acute obstruction, or acute strangulation, there is at first shock, from which the patient usually reacts for a time. In obstruction there is constipation, which soon becomes absolute, not even wind being passed; vomiting is early—first of the contents of the stomach, next of bilious matter, and finally of feces (stercoraceous); the abdomen becomes distended and tender. After reaction from shock some fever may be noted, but in any unrelieved case collapse soon arises; the temperature becomes subnormal; the face Hippocratic; the pulse rapid and feeble. The amount of urine passed is very small. In obstruction of the upper third of the ileum true fecal vomiting cannot occur. If obstruction is high up in the small intestine, tympanites does not occur. The tongue is dry, the mind is clear, and muscular cramp may occur. Intestinal peristalsis above the obstruction may be detected through the abdominal wall.

Symptoms of Chronic Obstruction.—At intervals there arise attacks of pain which become gradually more frequent and severe, and are linked with vomiting and constipation, the vomiting not being stercoraceous and the constipation not being absolute. Between the painful seizures the patient complains of constipation alternating with fluid diarrhea, distention of the belly, some abdominal uneasiness, anorexia, and dyspepsia. The attacks recur with increasing frequency and severity, and acute obstruction may arise or the patient may be worn out by pain, vomiting, and want of food.

Diagnosis.—*The determination of the seat of lesion* requires abdominal and rectal examination. An intussusception may sometimes be felt. Vaginal examination may be demanded. Pain is apt to arise at the seat of obstruction or to radiate from there. Palpation may detect a tumor. Rectal insufflation of hydrogen may locate the obstruction by causing great distention below it. Entire suppression of urine, early vomiting which is not truly stercoraceous, absence of abdominal distention, and rapid collapse mean obstruction in the duodenum or in the jejunum. Early vomiting, which is often stercoraceous in a rapidly progressive case with great distention of the umbilical region, means obstruction of the ileum or the cecum. Distention of the entire abdomen and of the flanks, linked with tenesmus, with less intensity of symptoms, less rapidity of progress, and less diminution of urine than in the above-cited forms, means obstruction low down in the colon or in the rectum. A test for obstruction in the adult large intestine is an injection by a fountain-syringe; if six quarts can be introduced, there is no obstruction in the large intestine; if less than four quarts can be introduced, there is probably obstruction in the large intestine. The passage of a sound in the rectum is generally useless and is often unsafe. In many cases the seat of the lesion and the cause of the obstruction can only be determined by exploratory laparotomy.

The determination of the causative condition is always difficult and is often impossible. *Intussusception* is the common cause in children. A sausage-shaped tumor can usually be felt in the right iliac fossa, tenesmus exists, and bloody mucus is passed. The abdomen is rarely distended or tender. Vomiting occurs, but it is seldom stercoraceous. The prolapse may sometimes be detected by digital exploration of the rectum. In *obstruction*

from bands, internal hernia, etc., there is a record of antecedent peritonitis, of a traumatism, of a violent effort, or of pelvic pain. The attack is sudden in onset, is fierce in character, and is usually excited by violent exercise or the taking of food. Vomiting is early and intractable, and it soon becomes stercoraceous; pain is violent; peristalsis above the obstruction is forcible; tympanites and abdominal tenderness appear after the attack has lasted for some little time; obstruction is complete, no wind even being passed; collapse soon arises; no tumor can be detected, and rectal examination is negative. *Volvulus*, which is usually located in the sigmoid flexure, is preceded by constipation. The symptoms come on with explosive suddenness, and rapidly attain great severity. Constipation is absolute; vomiting is late and is rarely stercoraceous; no tumor can be detected; rectal examination is negative; abdominal distention and tenderness are early and pronounced; peristalsis above the volvulus is vigorous; collapse is not so rapid nor so grave as in the previously considered forms. *Obstruction by a foreign body* may sometimes be inferred from the history of some such body having been swallowed. The obstructing body may occasionally be felt during palpation, or may be discovered with the x-rays. Abdominal distress may exist for days or weeks before obstruction occurs. Vomiting is late and is rarely severe, but pain, tenderness, and distention are marked. In obstruction from gall-stones there will be a record of one or more attacks of hepatic colic. Pain is early and acute, and vomiting is invariable and usually becomes stercoraceous. In *obstruction from fecal accumulation* chronic obstruction evolves into acute obstruction, pain and vomiting are late or even absent, and the dough-like mass of feces may often be felt by rectal examination or by abdominal palpation. In some cases the fluid elements of the feces pass, but the solid elements agglutinate to the walls of the bowel (the diarrhea of constipation). *Obstruction from stricture or from pressure* comes on acutely after a prolonged period of disturbance, during which period attack after attack of temporary obstruction, complete or partial, takes place. A history of blood or pus in the stools would indicate tumor of the bowel; a history of blood or pus having been absent would indicate pressure from without. In *functional obstruction* there is no local pain, no tenderness, no tumor, no tendency to collapse, but simply distention and absolute constipation, and possibly non-fecal vomiting occurring in a neurotic or hysterical subject. A phantom tumor due to a local distention of the intestine from limited muscular spasm disappears under ether. *Obstruction of the mesenteric vessels* causes abdominal pain, but early in the case there is no tenderness, rigidity, or distention. Moderate vomiting may occur, there is great restlessness and sometimes bloody diarrhea. Obstruction may follow an abdominal operation (*post-operative obstruction*); it may arise a day or so after operation; it may arise in ten or twelve days after operation; it may not arise for weeks or months (Legeve). It may be due to some cause at the seat of operation (adhesion of the bowel to a raw surface, volvulus, catching of the intestine under adhesions, etc.). It may be due to some cause distant from the seat of operation (displacement of intestine, bands, etc.). It may arise from paralysis of a portion of the bowel, which may or may not be due to sepsis.* It may be due to thrombosis of a mesenteric vessel. The

* Legeve, Gaz. des Hôp., Nov. 23, 1895.

symptoms of *post-operative thrombosis of the mesenteric vessels*, according to A. E. Maylard,* are as follows: Abdominal pain, perhaps colicky in character, gradual or acute in onset, and as a rule constant. Early in the case there is no abdominal tenderness, no distention, and no rigidity. The pulse is rapid, the patient is extremely restless, there may be vomiting, but it is never violent, as in acute obstruction, often there is diarrhea, and sometimes bloody diarrhea. These symptoms become particularly significant if there is cardiac or vascular disease. *Obstruction from Meckel's diverticulum* is usually acute, but is sometimes chronic, and occurs particularly in young adults and children. It has been stated that other and visible deformities are usually present, but in a study of 69 cases by A. E. Halstead† this was true of but one case, in which harelip existed. In obstruction from Meckel's diverticulum there is often a history of former mild attacks (Halstead). Halstead sums up the symptoms as follows: As the obstruction is high up, the abdomen is the shape of an inverted cone; early in the attack there is often local meteorism, especially under the costal arch of the right side, but there is no distention in the flanks. Early, active peristalsis may be visible. The tenderness is just to the right of the umbilicus, on a level with it or below it. In most cases there is early fecal vomiting.‡

Recognition of Intestinal Obstruction from Other Diseases.—Always examine for a strangulated hernia at every hernial outlet. If obstruction is complicated with an irreducible hernia above the seat of lesion, the hernia will always enlarge and become tender because of accumulation of feces. Functional obstruction may attend peritonitis or may follow the reduction of a hernia. Appendicitis with peritonitis may cause symptoms similar to those of obstruction; but there are fever, a history of pain in the right iliac fossa, and the vomiting is not stercoraceous. Acute pancreatitis produces symptoms so similar to those of intestinal obstruction that a diagnosis cannot always be made. Poisoning by arsenic or by corrosive sublimate should not be confounded with intestinal obstruction.

Prognosis.—Without surgical interference most cases of acute intestinal obstruction die within ten days, usually within seven days. Death may be due to shock, to exhaustion, to perforation, to peritonitis, or to obstruction of respiration and circulation by tympanites. Recovery occasionally happens by the formation of a fistula externally or into another portion of the bowel. In acute obstruction from foreign bodies the obstructing body occasionally passes. Volvulus and strangulation by bands are almost invariably fatal unless an operation is performed. In intussusception recovery occasionally follows the sloughing away of the prolapsed gut, but stricture almost inevitably results from this rare event. Functional obstruction gives a good prognosis. The prognosis of chronic obstruction depends upon the causative lesion. It does not threaten life immediately to anything like the degree that acute obstruction does.

Treatment.—In any abdominal case in which the diagnosis is uncertain and the patient is shocked, give an enema of brandy and hot water, wrap the patient in blankets, surround him with hot-water bottles, and study the development of symptoms and signs. In half an hour, as a rule, reaction

* Brit. Med. Jour., Nov. 16, 1901.

† Annals of Surgery, April, 1902.

‡ Annals of Surgery, April, 1902.

will be brought about, and a probable diagnosis may be made (Greig Smith). In acute obstruction it is usually customary to empty the stomach by lavage and to evacuate the rectum by means of copious injections given while the patient is in the knee-chest position. Hutchinson's method of taxis and massage is uncertain, and is as liable to inflict harm as to confer benefit. Some surgeons apply constant compression to the abdomen by means of straps of adhesive plaster. Puncture of the intestine with an aseptic hypodermatic needle introduced obliquely to relieve gaseous distention is a decidedly dangerous proceeding. The passage of a small tube from the anus to the sigmoid flexure will empty the colon of gas if no obstruction intervenes. In intussusception give no food by the stomach; administer opium and belladonna to arrest peristalsis, wash out the rectum with copious injections, give an anesthetic, and insufflate hydrogen gas or carbonic acid gas in order to distend the bowel. Some surgeons treat intussusception by forcing air into the rectum by means of an ordinary bellows, and others inject water by a fountain-syringe, the reservoir standing at a height of three feet. D'Arcy Power believes in the value of hydrostatic pressure in intussusception in children. He states that the child should be anesthetized and the large intestine filled *gradually* with hot saline fluid, the reservoir not being raised more than three feet above the patient. The fluid should be retained for ten minutes. The author is of the opinion that whereas it is justifiable to try to reduce by gaseous or hydrostatic pressure during the first twenty-four hours of the attack, early operation gives a better prognosis and is safer and more certain. After the first twenty-four hours it is not justifiable to use gaseous or hydrostatic pressure because ulcer or gangrene may exist. Pressure cannot be accurately regulated, and if the bowel is much damaged may lead to rupture. If the case is not seen until after the first day, or if injections have been used and have failed, laparotomy should certainly be performed.

Frederick Holme Wiggin has made a study of the reported cases of laparotomy for infantile intussusception, and considers that operation done within the first forty-eight hours will give a mortality of 22.2 per cent.* (see Operation for Intussusception).

In obstruction of the main mesenteric vessels operation is of no avail. In obstruction of branches it may be possible to resect the involved region of bowel, a region which is found to be gangrenous or at least becoming so.

In obstruction from fecal impaction use large rectal injections and give small repeated doses of salines or of castor oil. If there are signs of inflammation, do not give cathartics, even in small doses, but give opium and belladonna to arrest vomiting and to relax spasm. Impactions in the rectum can be removed by the use of a spoon. In acute intestinal obstruction, if the symptoms grow worse, do not wait, but open the abdomen before collapse comes on and find the cause of the obstruction. If it is a gall-stone or enterolith, try to crush it without opening the intestine; if this fails, push it up a little distance, incise the bowel, remove the stone, and close the incision with Halsted sutures. Pilcher † reports 40 cases operated upon for gall-stone obstruction with 21 deaths. If there is fecal obstruction, break up the masses by pressure and push the fecal plug down without opening the bowel. If there is intussusception, reduce

* Med. Record, Jan. 18, 1896.

† Med. News, Feb. 8, 1902.

the prolapse and shorten the mesentery; but if reduction is impossible, perform an anastomosis or a resection and enterorrhaphy, or make an artificial anus. In volvulus untwist and shorten the mesentery; but if this is impossible, treat as an irreducible invagination. In obstruction from adhesions try to separate them and straighten out the bowel, stitching healthy peritoneum over each raw spot to prevent recurrence. Anastomosis may be necessary. In flexion separate the intestines, remove the flexion by a V-shaped incision, and suture the wound in the bowel (Senn). In chronic obstruction it is often advisable to perform an exploratory laparotomy, discover the condition, and determine what is to be done to correct it. Some tumors external to the bowel may be removed. Growths in the bowel-wall may be removed by resection of the involved portion of intestine, or an anastomosis may be performed, or it may be necessary to make an artificial anus. In obstruction from Meckel's diverticulum that structure may be found twisted, the gut near it may be kinked or twisted, or the diverticulum may act as a band, the bowel being caught under it or kinked over it. Intussusception of the gut below it sometimes occurs; so does invagination of the mucous membrane of the diverticulum; so does chronic inflammation and cicatricial narrowing of the diverticulum or gut (Halsted). The diverticulum may be gangrenous, perforated, or cystic.

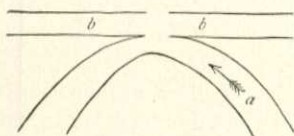


Fig. 364.—Fecal fistula: *a*, Direction of fecal flow; *b*, *b*, belly-wall.

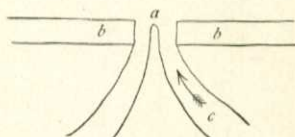


Fig. 365.—Artificial anus, showing spur: *a*, Spur; *b*, *b*, belly-wall; *c*, direction of fecal flow.

After opening the abdomen the surgeon must be guided by conditions. The diverticulum should be removed, just as the appendix is removed in appendicitis, and complications relating to the gut must be dealt with. Post-operative obstruction coming on soon after a surgical operation is often not recognized for a time, and the surgeon will be in doubt as to whether he is dealing with peritonitis or intestinal paresis. When in doubt wash out the stomach with warm salt solution, administer salines in small doses frequently repeated, employ enemata, and give two or three doses of atropin at intervals of two hours. Each dose should be gr. $\frac{1}{200}$. Atropin is given with the idea that it increases peristalsis and contracts blood-vessels. It is probably merely sedative, relaxes spasm, and is useless if strangulation exists. If these measures are not quickly followed by the passage of flatus or feces, open the abdomen; never wait for the advent of stercoraceous vomiting (see Legeve).

Fecal Fistula.—A fistula is an abnormal opening in the intestine through which gas or a portion of the feces escapes (Fig. 364). If all the intestinal contents escape through the opening, it is called an artificial anus (Fig. 365, Senn). A surgeon may make a fistula deliberately (intentional fistula). A fistula may be the product of disease or injury (accidental fistula).

Senn enumerates the following causes of accidental fistula: wounds, injury of the intestine, intestinal ulceration, intestinal strangulation, foreign bodies in the intestinal canal, malignant tumors, actinomycosis, pelvic and abdominal abscess, appendicitis, injury of the bowel during an abdominal operation, the application of ligatures, catching by sutures, and the employment of drainage-tubes.

Treatment.—Many fistulae close spontaneously. This can only be hoped for if the opening is quite small, if the general health of the patient is good, if the cause has passed away, if the fistula is not lined with mucous membrane, and if there is no spur (spur is shown at *a*, Fig. 365). In most cases of fistula not high up it is well to give Nature a chance to effect a cure, and not to be in a hurry to operate. The part is cleansed frequently with peroxid of hydrogen, the patient is kept recumbent, food is given which does not leave much residue, pads of gauze with pressure are applied, and the bowels are kept regular.

If the track is lined with granulations, it may be touched with lunar caustic; if it is lined with mucous membrane, the actual cautery should be applied; any collection of pus which exists should be drained. If these methods fail, an operation must be performed. The fistula may be sutured by extraperitoneal manipulation (Greig Smith); it may be covered with skin (Dieffenbach); the spur may be removed by means of a clamp; or resection may be performed. In most cases it is best to incise a button of skin around the opening, temporarily suture the fistula, open the peritoneal cavity, deliver the bowel, and suture carefully (Senn's method). In some cases partial exclusion of the fistulous part is necessary, the bowel being divided above the fistula, the end near the fistula sutured, and the other end anastomosed to the bowel below the fistula. In other cases complete exclusion may be performed (page 814).

Ulcer of the Bowel.—In typhoid fever and in dysentery ulceration occurs. An ulcer may be due to tuberculosis or cancer. An ulcer of the duodenum is due to the same causes as an ulcer of the stomach. An ulcer of the jejunum sometimes develops after the performance of gastro-jejunostomy* for gastric ulcer. *Curling's ulcer* is a chronic ulcer of the duodenum following a burn of the cutaneous surface. An ulcer may heal, and by causing thickening and constriction produce chronic intestinal obstruction. It may perforate, causing collapse and subsequent peritonitis.

Peptic Ulcer of the Duodenum.—Occurs usually in that portion of the duodenum which is above the opening of the bile-duct; in other words, only in the region acted on by the acid fluid from the stomach. Reversing the rule in gastric ulceration, duodenal ulceration is more common in men than in women. It may occur at any period of life, from early youth to extreme old age. An indurated chronic ulcer may exist, and this may heal and produce cicatricial stenosis. An acute ulcer is apt to perforate. Just as chronic gastric ulcer may be latent, no symptoms ever being observed, so may chronic duodenal ulcer be latent. Usually there is pain coming on about one hour after taking food, and located in the epigastric or right hypochondriac region. In one-third of the cases there is hematemesis, and sometimes there is blood in the stools. Severe hemorrhage is much rarer than in gastric ulcer. Moynihan* mentions the following complications:

* Lancet, Dec. 14, 1901.

Severe hemorrhage; perforation; periduodenitis; cancer; and cicatricial contraction involving the bile-duct.

Perforating ulcer is more common than we once thought. Moynihan gathered 49 cases from literature and added 2 of his own. In the great majority of cases perforation of the duodenum cannot be differentiated from perforation of the stomach by a study of the symptoms, but in some cases the symptoms resemble appendicitis. In most cases there is a sudden onset of violent abdominal pain, vomiting, shock, rapid pulse, and tenderness of the epigastric or right hypochondriac region. As a rule, after a few hours the patient reacts from shock. Sheild's case got better in four hours and walked some distance to the hospital.* Lucy's case got better a short time after the onset, walked home, and attended to a horse, but then became rapidly worse. The improvement is apparent, not real, and is only temporary. The symptoms quickly become worse, and when they become worse, besides the pain and tenderness and rapid pulse, there will be occasional vomiting, rigidity of the abdomen, usually an elevated or normal temperature, and possibly diminution of the area of liver-dulness.

Treatment.—In chronic ulcer operate if the symptoms are not amended by rigid diet and medication; if severe hemorrhage occurs; if cicatricial contraction interferes with the passage of food through the bowel or bile into the duodenum. Moynihan refers to four cases of chronic ulcer operated upon, and all recovered.

In perforation operation is performed as soon as the patient rallies from the primary shock. Operation is not performed in shock unless hemorrhage is thought to exist. The ulcer is inverted by two rows of silk sutures. Some surgeons do not drain, but I would feel it safer to drain. B. G. A. Moynihan † gathered 49 operations for perforated ulcer with 8 recoveries.

Perforated Typhoid Ulcer.—Perforation occurs in about 1 case out of 100. Perforation in a typhoid ulcer is usually effected rapidly, a large opening is formed, and a considerable quantity of fecal matter is passed into the peritoneal cavity. Severe pain, a nervous chill, and marked leukocytosis indicate that perforation is beginning to occur. This stage is known as the preperforative stage (Cushing). When perforation occurs, violent pain develops. As a rule, there is tenderness, rapid pulse, costal respiration, abdominal rigidity, vomiting, and shock. Usually there is temporary reaction from shock, the subnormal temperature giving way to a normal or to an elevated temperature. The vomiting in some cases becomes stercoraceous. There is constipation and sometimes dulness on percussing the flanks. The face is Hippocratic. The patient may die of the preliminary shock or may react and die subsequently of blood-poisoning.

Treatment.—Death is practically certain without operation. Operation should save about one-fifth of the cases. Operation should not be done in shock, but rather as soon as reaction is established. In many cases a general anesthetic should not be given, but a local anesthetic should be employed. The incision should be made in the right iliac region and the colon should be first located and then the end of the ileum. By locating the colon we obtain a fixed point from which to begin our search for perforation, and by opening in the iliac region we come down at once onto the

* Lancet, March 29, 1902.

† Lancet, Dec. 14, 1901.

perforated gut in the vast majority of cases. When a perforation is found it is inverted with two layers of Halsted sutures. It is not wise to excise the ulcer. If the bowel is very badly damaged resection can be considered, but it is usually wiser to make a temporary artificial anus. After finding a perforation and closing it, examine to see if there are others. Close every perforation, and if a point is found where the thinning of the bowel-wall indicates that perforation is liable to occur, protect this point by inverting the area of ulceration by sutures. Clean the peritoneum by eviscerating, wrapping the intestines in hot towels, wiping out peritoneal cavity and wiping particularly the peritoneal fossæ, the space between the liver and diaphragm, and the pelvis. The bowels are wiped off and returned to the belly and quarts of hot salt solution are used to flush the cavity. Leave the wound open and insert strands of iodoform gauze to afford drainage. Sometimes make suprapubic drainage and sometimes make a drain incision in the right kidney pouch. I have operated four times for typhoid perforation with a uniformly unfortunate result. Two cases died of shock. In one case the perforation was not found, but was discovered post-mortem in the hepatic flexure of the colon. One case improved greatly, lived for eight days, developed another perforation, and died of shock. The necropsy showed that the sutured perforation was soundly closed.

Primary Intestinal Tuberculosis.—According to Kocher, there are 80 cases on record. He reported 29 cases to the Swiss Medical Congress in 1892. Primary tuberculosis is very rare, whereas secondary tuberculosis is common. The exact propriety of rigidly regarding such cases as *primary* is doubtful. Kocher's cases came from tuberculous stock, and suffered in infancy from enlarged glands, pleurisy, or bronchitis, and that surgeon says that, in all probability, there had for some time been somewhere in the body a latent tuberculous focus, and from this focus came the bacteria which attacked the intestine. Primary tuberculosis begins with the formation of multiple ulcers, chiefly in the cecum. The symptoms, as a rule, are slight, attacks of pain occurring now and then, and stricture gradually developing. The urine shows the diazo reaction (Kocher). In some cases of intestinal tuberculosis there is enormous tumor-like thickening (hyperplastic tuberculosis).

Treatment.—In the first stage the proper treatment is excision of ulcerated areas, possibly excision of the cecum. Later, if stricture is causing chronic obstruction, an operation may be performed to give relief.

Malignant Tumor of the Intestine.—Sarcoma is very rare, but does sometimes arise, particularly in young persons, and it enlarges very rapidly. It is most prone to attack the large intestine. Jopson and White* report 1 case and also collect 22 others. The mesenteric glands frequently enlarge. Cancer is not uncommon, attacking especially the middle aged. It is most common in the neighborhood of the ileocecal valve and in the sigmoid flexure. Ewald collected 1148 cases of cancer of the intestine. In 64 cases the cecum was involved; in 24 cases the ileum was involved. It produces pain at the seat of growth, and after a time constipation, or constipation alternating with diarrhea, and finally intestinal obstruction. In some cases the symptoms appear suddenly, acute obstruction taking place or intussusception occurring.

* Am. Jour. Med. Sciences, Dec., 1901.

It is usually possible to palpate the tumor, which is hard and immovable. The patient wastes rapidly and is apt to occasionally pass blood at stool. The growth does not enlarge very rapidly and glands are not involved early. In some cases the supraclavicular glands enlarge. In more than one-half of the cases which die of intestinal cancer there is no lymphatic infection.*

Treatment.—Early in the case exploratory laparotomy should be performed, followed if possible by excision with end-to-end approximation. This is done for either cancer or sarcoma. It may be possible to remove enlarged glands. In cancer of the cecum extirpate the cecum and implant the end of the ileum into the side of the colon (Wm. J. Mayo). If excision is impossible, the growth should be sidetracked by performing lateral anastomosis. In advanced cancer of the large bowel, if resection is impossible, make an artificial anus above the tumor (cancer of rectum, page 865).

Appendicitis.—Appendicitis, which is an inflammation of the vermiform appendix of the cecum, is almost invariably the primary lesion of all of those various conditions known as typhlitis, perityphlitis, paratyphlitis, etc.—terms which no longer imply pathological entities, and are in most instances well relegated to obscurity. It was recognized by some observers many years ago that such a disease existed, but the majority of the profession did not grasp the fact. In 1750 Mestevier, of France, reported a case of perforative appendicitis with peritonitis.† In 1812 a perforated appendix was shown to the Medico-Chirurgical Society of London, and in 1835 Southam reported an appendiceal abscess (Manley). In 1849 Hancock reported an appendiceal abscess. In 1827 Dr. L. Méllier described appendicitis, and named among its symptoms fixed pain in the right iliac fossa and colic. This brilliant investigator was years ahead of his contemporaries. He reported cases of undoubted appendicitis verified by autopsy, described gangrene, perforation, associated peritonitis, and appendiceal concretions. His original article, Manley tells us, is in the "Journal of Medicine, Surgery, and Pharmacy" for 1827, Second Series, 110.‡ Méllier said: "If it were possible to establish with certainty the diagnosis of this affection, we could see the possibility of curing the patient by operation. We shall perhaps some day arrive at this result."§ In spite of Méllier's writings, the profession adhered for half a century to the view of Dupuytren, put forth in 1833, that abscesses in the iliac region take origin from the cecum and not from the appendix. Dr. Reginald Fitz, of Boston, in 1886 persuaded the world that the appendix is the real seat of most inflammations in the right iliac fossa. The appendix is a long and narrow diverticulum (musculomembranous in structure) which comes from the posterior and internal part of the head of the colon, and which has no physiological function (in herbivora and rodents it is a functionally active organ). The structure of the appendix is similar to the structure of the colon, except that the muscular structure is ill developed and trivial in amount. Lockwood points out that there is an extensive lymph system in the appendix, and that the submucous and subperitoneal tissues communicate by numerous gaps in the muscles.|| This structure has a poor blood-supply, and in conse-

* Wm. J. Mayo, Jour. Am. Med. Assoc., Oct. 19, 1901.

† Jour. Méd. et Chir., 1760.

‡ Thomas H. Manley, Med. Record, July 19, 1902.

§ See R. J. Lee Morrill's article in the Amer. Med.-Surg. Bull., Dec. 19, 1896.

|| Brit. Med. Jour., Jan. 27, 1900.

quence gangrene occurs from rather trivial causes. It is supplied by a branch from the superior mesenteric artery. In women there is sometimes an additional supply by a vessel running in the appendiculo-ovarian ligament. The nerves are derived from the superior mesenteric plexus. The appendix averages about four and a half inches in length, but varies in size between the limits of 1 inch and 9 inches, and its diameter is, as a rule, about equal to that of a No. 9 English bougie; its canal is narrow and is partly closed by the valve of Gerlach (Talamon). The appendix enters the cecum at its posterior internal part, which is usually the seat of the most intense pain in inflammation, and corresponds to a point on the surface two inches from the anterior superior spine of the ilium, on a line drawn from the umbilicus to the iliac spine, which is known as "McBurney's point." The free part of the appendix in one-third of all persons is in relation with the posterior surface of the cecum; in almost one-third of all persons it is fixed in the iliac fossa, so that if perforation occurs the contents will be voided in the retroperitoneal tissue (iliac abscess). In some cases it is external to the cecum; in some it passes downward, and in some inward. It is important to remember that the appendix may be met with in the most unexpected situations. When the ascending colon is displaced the diverticulum may be upon the left side. It is not unusual to find its tip in the middle line, up toward or adherent to the gall-bladder, or in the pelvis. In about two-thirds of all cases the appendix is completely covered with peritoneum; in one-third of all cases it is in contact, in some part of its length, with cellular tissue (Talamon). Robinson has called attention to the fact that the appendix is frequently in contact with the psoas muscle in men, and may be bruised by this muscle. In 10,000 autopsies the appendix is said to have been absent five times. In most cases where surgeons have been unable to find the appendix it was not absent but was covered with peritoneum. Occasionally the appendix is found in a hernial sac.

Etiology and Pathology.—Appendicitis is very rare in infants. I operated unsuccessfully on a male three years of age for gangrenous appendicitis. Savage operated unsuccessfully on a baby sixty-one days and Weiss operated unsuccessfully on a child twenty months old.* J. P. Crozer Griffith† has collected 15 cases in children under two years of age. One of these patients was three months of age. Nine of the 15 were operated upon, with 7 recoveries. In 4 of the cases the appendix was in the scrotum. In 2 cases a diagnosis of intussusception was made. Appendicitis is common at any period beyond childhood, being more frequent in young and middle-aged people than in the aged. It is about four times as common in males as in females. It is more common in summer than in other seasons and in warm countries than in cold or temperate climes. Appendicitis is a bacterial disease. It is produced occasionally by pus cocci, but most commonly by the action of the bacterium coli commune of Escherich. The colon bacilli, which normally inhabit the appendix, are harmless when the appendix is healthy, but become active for harm when the diverticulum is bruised, obstructed, irritated by the presence of uric acid, or congested because of chilling of the cutaneous surface of the body. When non-traumatic inflammation occurs swelling of the mucous membrane occludes the opening into the colon, and the lumen of the appendix

* Manley, in *Med. Record*, July 9, 1902.

† University of Penna. *Med. Bull.*, Oct., 1902.

dilates and fills up with a thick mucopurulent fluid: Ulcers sometimes form, which may only involve the mucous membrane, may pass deeply into the coats, or may even perforate. Dieulafoy * maintains forcefully that appendicitis is due *always* to the conversion of the appendix into a *closed* cavity, but cases are met with which disprove this assertion. Various conditions may bring about this transformation. Partial obstruction may be caused by calculi, which are composed of stercoral material and hordes of bacteria mixed with salts of lime and magnesia. These calculi are not formed in the colon, but are formed in the appendix. The theory that concretions form in the colon, and are forced into the appendix by peristalsis, has been very largely abandoned. Dieulafoy speaks of the condition as appendicular lithiasis, and says it has a tendency to run in family lines, and has a kinship with gout and rheumatism. Obstruction may be caused by local infection of a catarrhal area, by the formation of a fibrous stricture, or by several causes acting in unison. The presence of a concretion is always dangerous. It is frequently associated with ulceration, either as cause or effect. It is a mass of virulent bacteria. It may lead to perforation or gangrene. Talamon taught that the appendix resents the presence of the concretion, reflex contraction of the muscular coat taking place, which is accompanied by violent pain (appendicular colic). The muscular structure is so rudimentary that it does not seem probable that attempts at contraction, even should they arise, would produce violent pain and distant symptoms. Pozzi believes that appendicular colic may be caused by torsion or bending of the appendix, or malposition of the diverticulum, and holds that pain may arise when there is no lesion in the appendix and no inflammation of the peritoneum or pericecal structures.† What is called appendicular colic is really inflammation of the appendix without involvement of the peritoneum. The term appendicular colic has led to much injudicious conservatism, and, as Lockwood shows, if an appendix is removed from an individual who suffers from attacks of appendicular colic, it will usually be found that the diverticulum is inflamed or the lumen contains a concretion. Foreign bodies, such as pins, fish-bones, nails, buttons, date-stones, cherry-stones, and grape-seeds, may enter the appendix, but they do so far less often than is generally supposed, most alleged grape-seeds from the appendix being fecal concretions. Fitz found concretions in 15 cases out of 300. Ranvier collected the records of 459 post-mortems, and found reported 179 fecal concretions and 16 foreign bodies. Appendicitis due to a foreign body, such as a grape-seed or a pin, is known as *traumatic*; appendicitis in which a concretion is the assumed cause is known as *stercoral*. A foreign body may produce instant perforation. If impaction of a foreign body or concretion occurs, the orifice of the appendix is closed, the circulation is soon cut off, the secretions are retained, the coats become congested, the diverticulum enlarges enormously, microbes multiply with great rapidity, and the wall of the congested appendix inflames and may become gangrenous or ulcerated, and is finally perforated. Interference with the blood-supply of the appendix will predispose to appendicitis. This may be brought about by twists, bruises, adhesions, concretions, pressure, or bands; and the psoas muscle may play a part in the production of these conditions. In women appendicitis is occasionally secondary to tubo-ovarian disease. Appendicitis is rarer in women than in men,

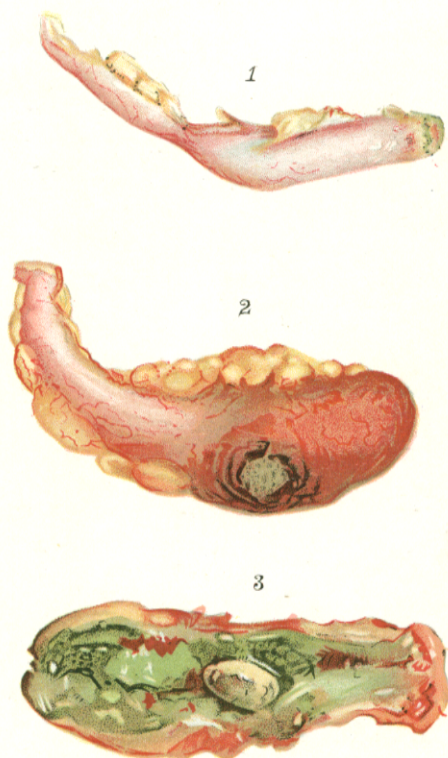
* Progrès médicale, No. 11, 1896.

† Progrès médicale, No. 19, 1896.

probably because in many females the appendix has a better blood-supply than in males, the additional supply coming through the folds of the appendiculo-ovarian ligament. In women disease of the uterus or adnexa frequently precedes or actually causes appendicitis. Catarrhal conditions of the intestine, habitual constipation, and indigestion with flatulence predispose to appendicitis. In fact, in a great majority of cases there has been a more or less prolonged history of diarrhea or constipation, and flatulent indigestion before the development of acute appendicitis. An acute attack of appendicitis frequently arises after the eating of a large and indigestible meal, especially if such a meal is taken late at night. Bolting the food and eating large meals at irregular hours predispose. It seems probable that catarrhal appendicitis may result from extension of a catarrh of the colon, and may also in rare cases arise from external traumatism. In most cases, however, in which appendicitis seems to be produced by a blow, the injury simply awakened a sleeping dog and stirred into activity an appendix already diseased. If before perforation the appendix adheres to the cellular tissue behind the cecum, cellulitis or abscess without peritonitis may result. When appendicitis goes on to perforation, there is always some peritonitis; but if the steps to perforation are gradual, and if the causative organism is the colon bacillus, the peritonitis may be local, and will sometimes by formation of adhesions make a barrier between the appendix and the peritoneal cavity before perforation occurs. When perforation takes place suddenly diffused septic peritonitis is inevitable. When the causative organism is the streptococcus general peritonitis is very apt to arise. Peritonitis may arise without perforation by contiguity of structure or by migration of bacteria through the congested walls of an obstructed appendix. In some cases perforation takes place into the peritoneal cavity, but pus is circumscribed by matting together of the intestines with plastic exudate. The appendix may become gangrenous very rapidly or after some time. A case of appendicitis in which gangrene and perforation come on very quickly is spoken of as fulminating appendicitis. In some cases, if the perforation is very small and the appendix is swathed in lymph, or if perforation does not occur, the inflammation may subside. Perforation rarely occurs from liquid pressure or from the pressure of a concretion; it is generally due to ulceration produced by the action of micro-organisms. Appendicitis which subsides may at any time recur, and the life of the patient is under constant menace. An enormous number of people have had appendicitis. Toft recorded 500 autopsies, and in 36 per cent. of them there were positive signs of past attacks. The disease is occasionally unsuspected during life. These facts prove that the disease may subside without the aid of surgery.

Forms of Appendicitis.—In what is known as *appendicular colic* the appendix is temporarily obstructed because of transitory inflammatory swelling of the mucous membrane of the outlet, and the stercoral contents are retained in the diverticulum. The peritoneal covering is not involved in the inflammation. This condition is called by Fergusson "constipation of the appendix." If not relieved, it will eventuate in appendicitis with involvement of the peritoneum. It is an unfortunate term, sometimes used as an excuse for avoiding operation. In such cases a concretion is frequently or usually present.

Simple parietal or catarrhal appendicitis is not limited to the mucous membrane; hence the term *catarrhal* is not strictly correct. The vessels of the



Various forms of appendicitis (from drawings by Dr. M. H. Richardson): 1. Obstruction from stenosis of appendix. 2. Dilatation of distal end of appendix; perforation by a fecal concretion. 3. Gangrene of nearly the whole of the appendix; fecal concretion in lumen.

appendix are distended with blood, the lumen at the intestinal end becomes partially or completely obstructed, the epithelium desquamates from numerous glands, the mucosa ulcerates, and the lumen of the appendix becomes filled with a mixture of mucus, bacteria, and portions of organic matter. Bacteria enter the lymph-spaces of the wall of the appendix, and pass rapidly from the submucous to the subperitoneal tissues. Within forty-eight hours after the mucous coat begins to inflame the peritoneal coat will probably be involved. This inflammation may undergo resolution and the patient get well or events may result disastrously. The appendix may thicken and ulceration take place. Suppuration or gangrene may occur, perforation may take place, or pyemia, with abscess of the liver, may arise. The acute condition may pass into chronic appendicitis, or ulcerations of the mucosa may remain; the mucous crypts may be filled with bacteria; a concretion may exist; cicatricial contractions may occur; in any one of these conditions the patient is in danger of a fresh attack at any time. In a catarrhal inflammation secondary to catarrh of the colon the case may be chronic from the beginning. If the lumen of the appendix is gradually and completely obliterated, the condition is denominated *obliterative appendicitis* (Senn). This progressive obliteration may result from repeated attacks of inflammation or may be simply a degenerative change. Recurrent appendicitis, it has been said, may be due to inordinate size of the mouth of the appendix, making of this diverticulum a drag-net for foreign bodies; but it is more probable that it is due to smallness of the opening, so that it quickly closes from slight swelling and converts the appendix into a closed vase filled with septic material. *Suppurative appendicitis* is due to purulent infiltration of the walls. Pus in the lumen is not purulent appendicitis. Pus may form about the appendix, a condition known as *appendiceal* or *appendicular abscess*. *Gangrenous appendicitis* is a moist or septic gangrene, due to interference with the circulation and to tissue-destruction by the action of micro-organisms. Perforations occur, and they are often multiple. The entire appendix may slough off. Interference with circulation may be caused by an obstruction, by a bend or twist or bruise of the appendix, or by the action of virulent organisms on an appendix whose tissue-resistance is lowered by injury or disease. In gangrenous cases the vessels of the meso-appendix are usually obstructed by thrombi or the changes of arteritis (Van Cott). In rare instances appendicitis is due to tuberculous ulceration, in other cases to typhoid ulceration, and genuine appendicitis may arise during typhoid fever.

Fowler suggests the following classification of cases of appendicitis: (1) endo-appendicitis; (2) parietal appendicitis; (3) peri-appendicitis; (4) para-appendicitis.

As a matter of fact, appendicitis is always one disease, which varies in intensity, and it is useless to divide it into a great number of symptomatic groups.

Symptoms and Signs.—In what is known as appendicular colic the patient suffers from disorder of digestion and occasionally has a brief attack of abdominal pain associated with trivial and temporary tenderness in the right iliac fossa. The colicky pain is about the umbilicus and right iliac fossa; there is often nausea and usually constipation. This condition, if not soon relieved, is followed by the evidences of peritoneal inflammation. The symptoms of genuine appendicitis are as follows: In some cases the disease seems to begin

suddenly, but in the vast majority of cases for a few hours or a day or two there are distinct *premonitory symptoms*, among which are constipation and diarrhea, flatulence, nausea, and even vomiting, anorexia, dyspepsia, coated tongue, weakness, general gastro-intestinal uneasiness, colicky pain about the umbilicus, and the development of tenderness, a sense of weight, soreness or actual pain in the right iliac fossa. The acute symptoms suddenly appear after the premonitory symptoms have lasted a variable time, and the acute symptoms very frequently appear in the early hours of the morning. The tongue is coated and usually dry. Great thirst is often complained of. The face is expressive of pain, or later, in a severe case, becomes Hippocratic. The posture assumed for greater ease is one of recumbency with the right thigh and knee or both thighs and knees partly flexed. Leukocytosis is usually present (see remarks on Diagnosis). Respirations in acute appendicitis are shallow and thoracic. The development of acute pain is usually the most prominent symptom. The pain is at first located about the umbilicus or through the abdomen in general, this distant or generalized pain, according to Treves, corresponding to the distribution of the superior mesenteric plexus. Usually, in from twelve to twenty-four hours the pain becomes localized in the right iliac fossa, and associated with tenderness and hyperesthesia of the skin. The usual location of the pain in the right iliac fossa depends on the fact that the appendix is usually placed in that region. Occasionally when the appendix crosses the belly the pain is located on the left side, and occasionally, for like reasons, in the gall-bladder region, the right loin, or the pelvis. If the pain of appendicitis is violent, the patient presents some evidences of shock. Nausea is the rule in appendicitis; vomiting usually occurs early in the case, and in children is often violent and persistent. But in adults, after the early hours of the attack, vomiting occurs, as a rule, occasionally or not at all, although nausea is complained of. If vomiting persists, it points to diffusing peritonitis, to pus-formation, or to intestinal obstruction unless it results from the administration of morphin. There is usually constipation in acute appendicitis, although diarrhea occasionally occurs. As a rule, in appendicitis there is fever, not ushered in by a chill, but the temperature mounting in the course of a few hours to 102° or 103° F. or even higher. In a very mild case the temperature remains elevated for a day or two and then falls to normal. In severe cases it is apt to remain elevated for a longer period, but it is always to be borne in mind that in very grave appendicitis there may be very little elevation of temperature, no elevation, or actually a subnormal temperature. In gangrenous cases, and in cases in which a large perforation suddenly forms, and when general peritonitis develops there is usually, for a time at least, a subnormal temperature. A *sudden* drop of temperature indicates, as a rule, a peritoneal calamity. The pulse in appendicitis is in most cases rapid. A very rapid pulse (over 110) is significant usually of a severe case, and the auguries are especially ominous if the pulse is rapid but the temperature is normal or subnormal. Occasionally, however, a slow pulse exists, even in the worst cases.

Examination of the abdomen discovers, early in the case, general abdominal rigidity; but usually in the course of twenty-four hours or more, the general rigidity passes away, the abdomen distends more or less, and rigidity of the lower half of the right belly becomes evident and persists. If general peritonitis begins early, general abdominal rigidity does not abate or pass away.

If general peritonitis begins later, general abdominal rigidity, which was present at first but which passed away, returns. Rigidity may not exist in the very beginning of appendicitis—in a case in which the appendix is retrocecal or pelvic and in some abscess cases.

A symptom almost invariably present in appendicitis is tenderness. In some cases the tenderness is diffuse; in most it is localized, or at least most acute, in the right iliac fossa. The point where tenderness is usually most acute is a spot about 2 inches internal to the anterior superior spine of the ilium on a line drawn from that bony point to the umbilicus. This is known as "McBurney's point," and overlies the usual point of origin of the appendix. In some cases, however, the greatest point of tenderness is nearer the gall-bladder; in others in the loin; in others toward the umbilicus, in the mid-line, or on the opposite side; in others in the rectum. The seat of greatest tenderness depends on the situation of the appendix, and it is usually at McBurney's point because this usually overlies the origin of the appendix. The lesson is that in appendicitis there is a point of tenderness or of greatest tenderness in a region which the appendix could occupy. If tenderness exists on the right side and then develops in the left side severe spreading peritonitis usually exists (W. Meyer). When the appendix becomes gangrenous, local tenderness may for a time disappear, because the peritoneum of the involved region has become anesthetic; later, however, it returns, spreads, and may become general. In view of the fact that tenderness in the right iliac fossa is often demonstrable in tubal and ovarian disease, the sign in males "is of greater significance than in females" (A. H. Tubby, on "Appendicitis," Medical Monograph Series). Pressure upon the left side will, in some cases, cause pain in the right iliac region. When rigidity abates or disappears the case may go on to cure, but sometimes a mass becomes evident in the right iliac fossa. The mass, of variable shape, is at first hard, and if of any considerable size is dull on percussion. In some cases, when no mass is palpable through the abdominal wall, rectal examination detects one. This mass may be agglutinated bowel and omentum or a collection of coagulated inflammatory exudate. It may gradually disappear or an abscess may form. The evidences of general peritonitis are: great distention because of intestinal paresis, general abdominal tenderness, rectal tenderness, very rapid pulse, hiccough, persistent vomiting which may become regurgitation, and as Meyer points out, percussion dullness over the right iliac region or entire lower abdomen.

In some cases the symptoms, at first trivial, become grave. In some all the symptoms are violent from the beginning, the attack tends to linger, and is followed by persistent soreness of the appendix and harassing digestive disturbances. Any case of appendicitis may become suddenly desperately grave because of perforation or gangrene, and in any case general peritonitis may develop. After sudden perforation or rapid gangrene the temperature falls, hiccough begins, abdominal distention, pain, and tenderness become marked and general, and the pulse becomes very rapid. In some cases these grave symptoms are present almost from the start (fulminating cases). A sudden perforation produces collapse, and, if reaction takes place, general peritonitis arises. Peritonitis, be it remembered, may arise without either perforation or gangrene. If pus forms, it may be unlimited by adhesion. In such cases there is the rapid onset of fatal peritonitis and septicemia.

Pus may be limited by adhesions and be practically extraperitoneal. In such a case a lump is felt in the right iliac region, but dusky discoloration and edema of skin very seldom exist. The surgeon does not wait for fluctuation before he makes a diagnosis. In an abscess case there are usually irregular fever and sweating, but rigors do not occur. Hawkins says we should always suspect pus if the symptoms continue after the sixth day, and particularly when the symptoms abate and suddenly increase between the seventh and tenth days. A limited collection of pus may be liberated into the peritoneal cavity by rupture of the abscess-wall. Such a rupture may be caused by pressure or muscular effort; rupture is followed at once by shock and later by diffused peritonitis. An abscess may rupture externally, or into the vagina, intestinal tract, or bladder. It is desirable, if possible, to locate the situation of the appendix, and this is usually determined by locating the seat of swelling and of greatest tenderness. The surgeon should not lose sight of the fact that the appendix may be found in the most unexpected situations. In every case a rectal or vaginal examination should be made, in order to detect swelling and tenderness, and thus determine if the inflammation took origin in or has come to involve the pelvic region. Pain at the end of micturition points to involvement of the vesical peritoneum.* In cases where there is not *localized* swelling and tenderness,—for instance, in gangrenous or perforative appendicitis with general peritonitis,—“diagnostic localization” is impossible (Van Hook).

Terminations and Prognosis.—Acute appendicitis may terminate in death, in complete recovery, or in a condition of lowered vitality during the existence of which acute attacks are almost certain to occur. Sometimes after and sometimes without an antecedent acute attack the patient develops persistent soreness and tenderness in the right iliac region. Between the attacks of recurrent appendicitis there may be soreness, tenderness, and gastro-intestinal disturbance, or there may be no evident trouble whatever; yet, even in the latter case, there may be an ulcer or ulcers of the mucous lining. If a patient has once had appendicitis, he will always be liable to suffer from another attack if the appendix has not been removed. The liability becomes almost a certainty if the intestinal end of the appendix is narrowed or if the lumen is obstructed at any point, if a concretion exists, or if there is an area of ulceration or of desquamating epithelium. After an attack the appendix may remain enlarged and tender; exercise or indiscretion in diet may cause it to become tender, or the patient may have occasional attacks of colicky pain. If any of the above conditions exist, another attack may be confidently anticipated if operation is not performed. In such cases the appendix can usually be palpated. The method of palpation proposed by Robert T. Morris is very useful.† It is applied as follows:

The surgeon stands to the right of the patient and uses three fingers of the right hand to feel with and three fingers of the left hand to press with. Morris insists that no muscular effort should be used by the hand which feels. The feeling fingers are pressed by the other fingers beneath the margin of the right rectus muscle on a level with the umbilicus, and are drawn toward the patient's right side, and the colon will be felt to roll under the fingers.

* Van Hook, in Jour. Am. Med. Assoc., Feb. 20, 1897.

† See Medical Record, Sept. 17, 1898.

The process is repeated several times until the end of the cecum is reached. The appendix is sought for by rolling the cecum from side to side with the finger-tips, and working toward the proximal end of the appendix.*

Adhesions may form as a result of appendicitis, general peritonitis may arise, the appendix may slough or become perforated, or abscess may ensue upon local peritonitis. Lymphangitis of the appendix may accompany, and septic phlebitis and abscess of the liver may follow, appendicitis.

Among other possible consequences of appendicitis may be mentioned pyemia, subphrenic abscess, empyema, inflammation of the parotid gland, and thrombosis of the right iliac vein. A positive prognosis of any case of appendicitis is an absolute impossibility. The future of every case is cloudy with uncertainty, and the most that can be attained in the field of prediction is a scientific guess of more or less probability. All surgeons have seen apparently hopeless cases recover, and have observed cases with the most trivial symptoms grow progressively worse or suddenly develop a fatal complication. Further, after one attack, other attacks are very apt to arise. The medical man who estimates that 80 or 90 per cent. of cases get well without operation has probably dealt with many catarrhal cases, and he certainly is optimistic as to freedom from future attacks, because, as stated before, recovery from an attack does not of necessity mean freedom from the disease. In appendicitis there may be delusive evidences of improvement; for instance, the abatement of pain and the lessening of fever being regarded by the patient himself as indubitable signs of improvement, may in reality be indicative of gangrene. In spite of the previously mentioned difficulties and obscurities, we can in the majority of cases decide with a reasonable probability of accuracy whether or not the patient is becoming worse. In a delusive improvement some signs and symptoms improve, but all do not; and in endeavoring to form a prognosis, *all* the signs and symptoms must be noted and weighed: pain, tenderness, rigidity, distention, nausea and vomiting, delirium, intestinal obstruction, shock, the temperature, the rapidity of the pulse, the blood examination, etc. If *all* these elements, not only some of them, point to improvement, we may be reasonably confident that improvement is really taking place. If only some of them point to improvement, we will in many cases be altogether uncertain as to the significance of the change.

Diagnosis.—The diagnosis is not invariably certain, as many light-hearted operators seem to believe. It is frequently far from easy and is sometimes altogether impossible without exploratory operation. Sonnenburg maintains that we can diagnosticate the pathological condition of the inflamed appendix. Personally, I am unable to do this with any certainty, although I always try, and am often right and just as often wrong.

In attempting to make a diagnosis, besides the ordinary examination of the abdomen a rectal or vaginal examination should be made, associated in many cases with bimanual palpation. If an appendix is enlarged and an individual has a thin abdomen which is not rigid, it is often possible to palpate the appendix. Sometimes it can be felt after the administration of ether when it could not be detected before. In an acute case forcible or prolonged palpation is always unjustifiable, as it may force an ulcer to

* Robert T. Morris, in Medical Record, Sept. 17, 1898.

perforate, or may rupture an abscess, and the information gained is not of sufficient importance to justify the risk. In a chronic case information of great value may be obtained and there is no real risk in the maneuver.

The disease may be confused with a number of different conditions. It sometimes is confused with typhoid fever; in fact, an early typhoid fever associated with marked abdominal pain gives a picture very similar to that furnished by appendicitis.

In typhoid fever the temperature is usually distinctly higher than that commonly encountered in appendicitis. Maurice H. Richardson * tells us that in every case in which typhoid is suspected, operation is not justifiable on the hypothesis of existing appendicitis, unless there is local pain and localized tenderness in the appendix region, associated with definite muscular resistance or distinct rigidity; and that operation should be postponed in a case in which the constitutional signs are severe and the local signs are difficult to detect; but when there are pain, tenderness, and rigidity, with or without distention, operation must be performed, even when one recognizes the possibility of the existence of typhoid fever. Richardson lays down the following rule: Soft abdomen plus high temperature suggests typhoid, even if there is pain and tenderness. In appendicitis there is usually leukocytosis; in typhoid leukocytosis is absent, except when perforation is imminent. I have seen the operation performed twice for supposed appendicitis when the condition in each case was found to be early typhoid fever.

Acute intestinal obstruction is sometimes confused with acute appendicitis, and the mistake is particularly likely to occur if the obstruction is due to intussusception. In acute obstruction, as in appendicitis, the pain is first appreciated about the umbilicus; but in acute obstruction it remains in that region, does not pass to and localize itself in the right iliac fossa, and is not associated with tenderness of the right iliac fossa. In obstruction the vomiting is persistent; in appendicitis, except in the beginning, it is usually trivial and often absent, although in children it may be violent and persistent. In acute obstruction shock is much more pronounced than in appendicitis, and early and great distention of the abdomen is noted. The temperature of obstruction is usually subnormal; while in appendicitis, at least in the majority of cases, the temperature is distinctly elevated. Further, in acute intestinal obstruction the constipation is absolute, except in cases of intussusception. In children, intussusception is capable of particularly confusing the diagnosis, because, after the first day, it is by no means unusual to have distinct fever in this condition, and occasionally a tumor-like mass is found in the right iliac fossa; but in intussusception the tumor does not remain fixed, but alters its position; it is movable; and the patient usually suffers from tenesmus and the passage of bloody mucus. One should bear in mind that in acute appendicitis associated with septic peritonitis, acute obstruction may exist; and that the diagnosis of obstruction may be made without recognizing the appendicitis.

Lesions of the kidney are sometimes mistaken for appendicitis, but in renal colic the pain runs into the groin and testicle of that side, and occasionally passes down the front of the thigh or into the rectum; and if any tenderness exists, it is found in the loin or in the groin, rather than in the right

* Boston Med. and Surg. Jour., Jan. 9, 1902.

iliac fossa. Besides this, there are other symptoms of kidney trouble. The urine may contain blood or pus, and there may be a history of difficult or of frequent urination; though one should bear in mind that in appendicitis with an appendix attached to the bladder, there may also be a record of urinary difficulties. An x-ray picture may exhibit a calculus in the ureter or kidney, and a movable kidney is distinctly palpable. In ordinary renal colic there is vomiting in the beginning, just as in the beginning of appendicitis. In movable kidney the vomiting is often more violent and prolonged than is common in appendicitis. Movable kidney and appendicitis may exist coincidentally.

Gall-bladder difficulties, too, may be confounded with appendicitis. I have operated upon a case of cholecystitis, under the supposition that it was one of appendicitis; and upon a case of appendicitis with the appendix adherent to the gall-bladder, in the belief that the condition was cholecystitis. In an inflammation of the gall-bladder, with a distended gall-bladder, hanging low down, and with muscular rigidity, the distinction is always difficult and sometimes impossible. In ordinary gall-stone colic the condition is usually sudden in onset; it is characterized by pain in the epigastric region, passing toward the shoulder-blade and the shoulder, the pain being most acute and becoming more or less localized in the region of the gall-bladder; and there is always tenderness over the gall-bladder region. In gall-bladder colic the vomiting is violent and continuous.

The perforation of a gastric ulcer or of a duodenal ulcer may be diagnosed as appendicitis. In perforation of a gastric ulcer there is usually a history of previous difficulty with the stomach; though this is not always the case. The onset of perforation is sudden, with much greater shock than is characteristic of the onset of appendicitis. The pain is violent and the pain and rigidity and tenderness are in the epigastric region.

Among other conditions that may be confused with appendicitis may be mentioned malignant disease of the cecum, tuberculosis of the cecum, acute tuberculous peritonitis, twisting of the pedicle of an ovarian tumor, tubal disease, extra-uterine pregnancy, membranous colitis, perinephric abscess, tuberculous abscess of the loin or of the groin, and abscess from hip-joint disease.

In reaching a diagnosis in doubtful cases of appendicitis, I believe that the blood-count is often of service. It is, of course, not to be maintained that the diagnosis of appendicitis may be made by counting the blood; but the blood-count may furnish evidence that, when added to the other signs and symptoms, may be of great importance. In nearly every case of appendicitis the hemoglobin is diminished by at least 30 per cent. In a catarrhal appendicitis or in an interstitial appendicitis the leukocytosis is trivial; but in cases of abscess or of gangrene of the appendix the leukocytes, as a rule, rise from fifteen to twenty thousand. It is to be remembered, however, that when the patient is profoundly septic, the systemic condition is so depressed that leukocytosis is impossible; hence, leukocytosis may be absent in trivial catarrhal cases or in grave cases with overwhelming general sepsis. This latter condition, however, is extremely rare. The blood-count will not help one in making the differentiation between appendicitis and an inflammatory disorder of the pelvis or abdomen, but will aid one in making a

diagnosis from typhoid fever, intra-abdominal or pelvic neuralgia, and movable kidney (see J. C. DaCosta, Jr., study of 118 cases: "Am. Jour. Med. Sciences," Nov., 1901).

Appendicitis in Children.—The disease is more common than was once thought (page 726). The onset is usually sudden and the symptoms as a general thing are violent. Vomiting is usually more violent and prolonged than in adults. Abscess seems especially prone to form, but general peritonitis is by no means uncommon. Occasionally in young children pneumonia begins with symptoms which seem to point to appendicitis, and an attack of appendicitis may begin with pulmonary inflammation. I have seen two cases in which pneumonia was ushered in by abdominal pain.

Appendicitis in Pregnant Women.—Appendicitis is not common during pregnancy. When it does occur, it is more dangerous

than in the non-pregnant. In about 40 per cent. of cases abortion occurs, and usually the child dies from infection. In some cases of successful operation pregnancy continues to term. The diagnosis is often very difficult because of the enlarged uterus.

Tuberculous Appendicitis.—Acute symptoms may develop resembling acute appendicitis. There is usually a history pointing to stenosis, the stenosis existing at the ileocecal valve.* There is always great thickening and an abscess of large size is apt to form (Fig. 115). The cecum usually, but not

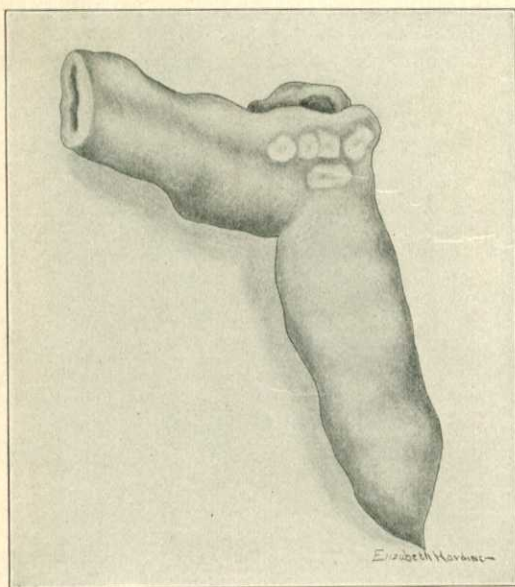


Fig. 366.—Tuberculous appendix with perforation and abscess.

always, is involved in the tuberculous process. Chronic cases, with palpable enlargement, are sometimes mistaken for cancer.

Treatment.—If the diagnosis were always certain from the beginning, and if the cases were seen at the very start by a surgeon, immediate operation in every case would be eminently proper. If this plan could be followed, the mortality from appendicitis would be extremely small. At this early stage the peritoneum is free from infection, and the appendix can be rapidly and easily removed without risk of infecting the peritoneum. Unfortunately, this plan cannot be habitually followed. As a rule, when the physician first sees the case the appendicular peritoneum is inflamed, and the surgeon usually sees the case at even a later period than the physician. At this time the barriers of leukocytes are being heaped up to limit the spread of

* Andrews, *Annals of Surgery*, Dec., 1901.

infection, and delicate encompassing adhesions are usually being formed. Operation at this stage may be imperatively necessary, because of the rapid spread and dangerous nature of the process; but when operation is not done, in most cases at least a temporary limitation will be secured and the case will go on to an interval. Operation in this period is always dangerous; operation in an interval is safe. In many instances it is wiser to avoid operating when the case is first seen, and it is proper to wait for an interval. The period in which the surgeon usually sees the case for the first time is said by McBurney to be "too late for an early operation and too early for a late operation." Those who say, "operate as soon as the diagnosis is made," operate as a rule in this dangerous period, and in this period I do not believe that every case should be promptly cut. Many cases, it is true, must be operated on as soon as seen, irrespective of the duration of the disease. We must operate promptly if the pulse is small and well above 100; if there is persistent vomiting; if there is delirium; if intestinal obstruction exists; if a chill has occurred; if the pain and rigidity are very marked; if a mass can be felt in the right iliac fossa or by rectal examination; if there is marked abdominal distention; if there are evidences of pus-formation; if the patient is growing worse; if there is or has been shock; or if the pain suddenly passes away without the use of opiates.

In an ordinary mild case, in which none of the above-named conditions or symptoms exist, it is best to defer operation. Those who advocate operating upon every case consider such delay reprehensible and dangerous, point out that even in apparently mild cases gangrene or perforation may quickly occur, and cite striking cases to emphasize their belief. There is much force in this view and it must not be hastily rejected. The choice, however, is not between a dangerous delay and a safe operation, but is rather between a dangerous delay and a dangerous operation. It is a question of two dangers, and each side chooses the danger which seems to it the least. Richardson's elaborate study of 750 cases, showing a mortality of 18 per cent. in operations for acute appendicitis, determines us in the practice of the more conservative plan.

In an ordinary mild case of appendicitis the patient is purged by means of Epsom or Rochelle salt. This practice was begun because of the belief that inflammation of the appendix is associated with fecal impaction in the head of the colon. This belief has been exploded, but the treatment is still used, because experience shows that it is beneficial. If the condition of the stomach prevents the administration of salines, high enemas should be given.

Opium is never given. In the first place, it is not needed, for if the pain is so violent as to absolutely demand opium, operation should be performed. In the second place, opium masks the symptoms, makes the patient feel comfortable, and gives the physician an unfortunate and ill-founded sense of security. The pain about the umbilicus, if severe, can be distinctly and safely relieved, by the administration of thirty minims of chloroform every half hour until three doses are taken. When tenderness can be demonstrated in the right iliac fossa an ice-bag should be applied.

The case should be seen again within six hours. We are accustomed to follow McBurney's rule, which is as follows: If on seeing the patient

again, six hours after the first visit, the patient is worse, operate at once. If he is no worse, there is no pressing danger.

If in twelve hours after the beginning of the attack the symptoms are not intensified, they will soon begin to abate; if the symptoms have become worse during this time, operate. If in twenty-four hours after the beginning of the attack the severity of the symptoms lessens, it is usually possible to wait for an interval; but if during the second twenty-four hours the abatement in the severity of symptoms has not gone on and there is doubt as to the condition, operate at once.* If operation is not performed, the patient is restricted to a liquid diet and the bowels are moved daily by salines.

If pus is present, some surgeons delay operation in the hope that firm adhesions will form around the pus, and that the necessary operation will simply be the opening of an abscess. I do not believe it is safe to delay operation in a pus case. The pus may become limited, but it may instead pass up toward the liver or down into the pelvis. Delay is fraught with peril.

When the attack has subsided, and about three weeks or more have passed, the appendix can be removed with remarkable safety. After a patient has had two or more attacks of appendicitis all surgeons agree that the appendix should be removed.

If only one attack has occurred, there may never be another, and the question arises, Should the appendix be removed after one attack? We do not know that a man has really recovered after purely medical treatment. Many cases reported as cured by medical means have subsequently required operation. As Lockwood puts it,† "To say that a man with appendicitis has been cured by medical means is in many cases equivalent to saying that a man with a stone in his bladder has recovered from calculus after the cure of a cystitis by rest in bed."

Even after a first attack, if the appendix remains tender or becomes tender after exercise, or if attacks of colicky pain occur, operate.

In some cases a single attack of appendicitis is followed by persistent dyspepsia and ill health, and in such cases operation should be performed. In the majority of cases, after even one well-marked attack, operation is necessary. It is always necessary after two attacks (see Operation for Appendicitis).

Appendicitis in a child is treated exactly as in an adult. Appendicitis in a pregnant woman is treated as in the non-pregnant. Early operation is particularly indicated, and it is not proper to induce premature labor.

When operating upon a woman, bear in mind that ovarian, tubal, or uterine disease may have preceded, actually caused, or resulted from the appendicitis; examine the adnexa and remove them if necessary.

An operation for tuberculous appendicitis is rather apt to be followed by a fecal fistula. An ordinary laparotomy is sometimes followed by cure, but the rule of operating should be, when possible, to remove the appendix and resect the diseased bowel. Andrews‡ mentions as expedients suited to special cases: total exclusion; partial exclusion; lateral anastomosis and the formation of an artificial anus.

* For McBurney's views, see N. Y. Polyclinic, Jan. 15, 1897.

† Brit. Med. Jour., Jan. 27, 1900.

‡ Annals of Surgery, Dec., 1901.

Splanchnoptosis.—This condition is due to relaxation of the abdominal walls, which permits the viscera to move downward. The prolapse may involve all of the abdominal viscera, one of them, or several of them. Prolapse of the stomach is known as gastropptosis (page 715); prolapse of the liver as hepatoptosis (page 753); prolapse of the spleen as splenoptosis (page 771); prolapse of the kidney as nephroptosis (page 934); and prolapse of the intestines as *Glenard's disease*.

The causative relaxation of the abdominal walls is most common in women, but is by no means confined to that sex. It may be produced by ascites, pregnancy, muscular effort, febrile maladies, or wasting diseases. In some cases no cause can be assigned. Such a relaxed abdomen may be thin; but is not unusually thick, the fascial strands and muscular fibers are stretched, thinned, and separated, the belly bulges downward and forward, and a viscus or the viscera follow because of lack of support.

Enteroptosis, or Glenard's Disease.—This disease is a prolapse of the intestine. It may be but a part of ptosis or prolapse of all the abdominal viscera; it may exist alone; it may be associated with movable kidney, prolapse of the stomach (gastropptosis), of the liver (hepatoptosis), or of the spleen (splenoptosis).

In Glenard's disease the intestines occupy the lower portion of the abdomen, and the belly below the costal margins is flat, is dull on percussion, and the pulsations of the aorta are very evident. The right portion of the transverse colon begins to descend first, and other portions of the intestine follow. The splenic and hepatic flexures are elongated and sometimes there is venous engorgement of dependent parts of the mesentery (Lambotte, in "Presse Med. Belge," 1901, Nov. 24). The victims of this disease are dyspeptic, anemic, and neurasthenic. The condition may arise without apparent cause, may be caused by wearing corsets, by falls, by blows, by lifting heavy weights, and by prolonged vomiting. The dyspepsia is due to dragging on the duodenum, the tube becoming flattened out (A. K. Stone). The flattening of the duodenum may be followed by kinking of the pylorus, and in such a case the stomach dilates, otherwise it does not dilate. Normally the tenth rib is firmly attached by fibrous tissue to the ninth costal cartilage. In enteroptosis the tip of the tenth rib is freely movable and obviously separated from the ninth costal cartilage (Stiller's sign).

Treatment.—In many cases medical treatment is of benefit. The following is the usual plan: Employ lavage, massage, and electricity; order a proper abdominal support; insist on regular exercise, and treat the anemia and dyspepsia. If ptosis of the liver, spleen, stomach, or kidney exists, operation may be necessary.

In enteroptosis good results are sometimes obtained by attaching the splenic and hepatic flexures to the abdominal wall (Lambotte's operation). Robt. T. Morris removes redundant peritoneum and transversalis fascia; scarifies and shortens the falciform and suspensory ligaments of the liver; rubs with gauze the upper surface of the liver and the under surface of the diaphragm and approximates the recti muscles. In two cases he also anchored a loose kidney.*

* Med. News, June 28, 1902.